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A Revision of the Tarsonemidae of the Western Hemisphere (Order Acarina)*†

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ABSTRACT.—The mite family Tarsonemidae was erected in 1877 by Kramer based upon the type genus *Tarsonemus* Canestrini and Fanzago, 1876. The family has been variously placed in the order Acarina by acarologists since that time, but evidence is offered for including the Tarsonemidae in the suborder Trombidiformes, a position recognized by some workers.

The family, formerly represented by two recognized genera, has been further divided so as to include five genera, one of which has been established in this paper to include a species heretofore undescribed. The new genera are *Stencotarsonemus*, with ten included species two of which are new, *Xenotarsonemus*, which is monotypic and *Rhynchotarsonemus* which is also monotypic, this latter genus being established to include a single new species. The old genus, *Tarsonemus* Canestrini and Fanzago, includes seventeen Western Hemisphere species, three of which are here described as new to science. The genus *Hemitarsonemus* Ewing includes three species one of which is new. Descriptions of mites included in this paper, with the single exception of *T. truncatus*, are presented in rather minute detail. The purpose of such a prolix dissertation is to place in the hands of acarologists in other parts of the world a useful tool for identification of tarsonemid mites, and hence characters not at present found to be significant in species differentiation are included with the hope of facilitating further investigations.

An attempt is made to establish phylogenetic relationships of the various groups and species within the groups. Such information as host correlation as well as morphological characteristics are considered in determining these relationships. Included also is a brief dissertation on morphology and terminology of tarsonemid mites as well as the bionomics of typical species.

The most recent revision of the group by Ewing in 1939 has undergone considerable change in this paper. Re-evaluation of the family Tarsonemidae

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has led to the separation of certain genera formerly included in the family and their transferral to other families. The family is redefined so as to include only two of Ewing's three genera comprising the subfamily Tarsoneminae. As a result the family here consists of Ewing's subfamily in part, with his remaining two subfamilies being elevated to family rank, an arrangement previously suggested or used in part by some other authors.

Important economic species of tarsonemid mites include the cyclamen mite, broad mite, fern mite, pineapple mite, sugarcane mite and others. The economic importance and control measures for certain species of the family are discussed. Some species, such as the peach bud mite, *Tarsonemus waitei* (Banks), and the species *T. setifer* formerly recognized as pestiferous are here considered as being only secondary invaders of dead or diseased plant tissues. To the list of economically important mushroom pests is added the species *T. waitei*, however.

The common usage of the term epimera, applying to conspicuous characters of the ventral integument, is discouraged, with evidence offered in support of the term apodemes as correct reference to such structures. Attention is directed to a hitherto unreported structure in this group of mites which is designated as the anal plate.

The bionomics of members of the Tarsonemidae is related in some detail. Sexually or parthenogenetically produced eggs hatch into six-legged, active larvae which eventually transform into a quiescent "pupal" stage from which eight-legged adults eventually emerge. Parthenogenetic reproduction results in male individuals only in the few species studied by this author. Other reliable records indicate that parthenogenesis in some species may result in females only or in both sexes. Tarsonemid mites in general appear to have a narrow or restricted range of ecological tolerances. Further work on tarsonemid ecology is encouraged as also is the need for detailed, comprehensive study of the taxonomy of Old World species.

INTRODUCTION

The first comprehensive work on the mites belonging to the family Tarsonemidae was published in 1939 by H. E. Ewing. Both prior to and since the appearance of Ewing's paper little has been added to the knowledge of the taxonomy of the group with the exception of the description of two new European species by Cooreman (1941, 1947). The number of papers published on mites in this family with other than a taxonomic approach have been prodigious, particularly those concerned with applied entomology or applied acarology.

The importance of tarsonemid mites to agriculture has long been established. The importance of this group in the fields of public health and medical acarology is a matter of record, yet to date no conclusive evidence has been presented to irrefutably incriminate tarsonemids as a direct cause of human suffering. This is not beyond the realm of possibility, however.

In order to better understand the mites of this family it is of primary importance to establish the relationships of the included species to each other and to establish names indicating these relationships. Because of existing difficulties in classifying tarsonemid mites little interest in the group has been shown by collectors, an interest which often is not encouraged by the extremely small size of the mites. For this reason few noneconomic species have been collected, and many of those which have been collected have been very poorly mounted or preserved.

The writer's interest in this group of mites was first aroused early in 1949 during investigations of pest problems of nurseries in the San Francisco Bay Region of California. Extensive damage to numerous greenhouse crops was found to be caused by the cyclamen mite, and it is from identification of this species that further studies in the family stemmed.

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HISTORICAL ACCOUNT

The family Tarsonemidae was erected by Kramer in 1877 based upon the genus *Tarsonemus* Canestrini and Fanzago which then included two species. The genus *Chironemus* described in 1876 by Canestrini and Fanzago to include a tarsonemid species was discovered to be a name occupied in the Pisces; these authors made the correction of the homonym in a subsequent publication in the same year redesignating the genus *Tarsonemus*. As originally described the genus was monobasic including the single species *Chironemus minusculus*, generic characters being based upon the

female only as the male was unknown. At the time of correction of the existing homonymy a second species *Tarsonemus floricolus*, was described, again from females only.

As pointed out by Ewing in 1939, the original generic description permits recognition of mites belonging to the family which subsequently was based upon this genus in spite of the minor discrepancy on the nature of the claws of legs I. Recent findings appear to indicate that mites belonging to the family Tarsonemidae are characterized by a single claw on legs I which is contrary to the original interpretation of the character by Canestrini and Fanzago as well as by Ewing in his 1939 studies.

Early descriptions of tarsonemid mites were made by European workers; following the two species previously mentioned Kramer described *Dendroptus kirchneri* (1876) and Targioni-Tozzetta described *Tarsonemus oryzae* (1878). In the decade which followed, descriptions of five more European mites were added to the group. It was in 1904 that the first tarsonemids of the Western Hemisphere were described, that of *Tarsonemus pallidus* in 1899 by Banks being the first of this series. Before Ewing's 1939 revision of the Western Hemisphere species, seven species and one variety had been described from this part of the world, six species of which were recognized as valid in the publication mentioned.

With the fluctuating taxonomic arrangement of acarians through time, the family Tarsonemidae, like many other such groups, has run the gamut of adjustment to fit the various interpretations and evaluations of characters for separation of the higher categories. Kramer in 1877 related the Tarsonemidae to Sarcoptiform groups principally on the basis of absence of tracheal openings. This arrangement was followed by Trouessart in his review of the classification of mites which appeared in 1891, this author further identifying the group as showing affinities with the Cheyletidae. Reuter in 1909 transferred the Tarsonemidae from the position showing close relationship to the Sarcoptiform groups to one more closely allied to the Trombidiform groups. Ewing in 1909 and again in 1929 and 1939, following the lead of Berlese (1897), clearly indicated that the tarsonemid mites belonged in the suborder Heterostigmata, the claim based upon recognition of the position of the tracheal openings, together with the characters of body segmentation and presence of pseudostigmatic organs located between the bases of coxae I and II, this position interpreted as showing a close relationship to the Sarcoptiform groups. Oudemans in 1902 proposed several new names for higher categories of the Acarina, one being

the Trachelostigmata which included the tarsonemids as an isolated group having no close relationship to other known mite groups; this position has largely been abandoned in recent years, however. Banks in 1915 placed the family Tarsonemidae in the superfamily Sarcoptoidea the latter being one of the eight great groups of the order, this superfamily containing the family Sarcoptidae and six other families, all characterized by the lack of caudolateral stigmatal openings and the common occurrence of strong coxal apodemes or epimera and genital suckers. In 1929 and again in 1943 Vitzthum placed the family Tarsonemidae in the suborder Trombidiformes where it, together with several other families comprising the cohort Tarsonemini, showed close relationship to the prostigmate trombidiform mites, a position completely removed from the Sarcoptiform groups. This thesis is advanced by the present author with full knowledge that until a great deal more is known about the morphology and distribution of mites defense of several proposed alignments of the higher categories is tenable. Reasons for preference of the associations indicated are discussed further in this paper under the general subject heading of "Systematic Relationships." As mentioned previously, the most recent comprehensive work on the tarsonemid mites, namely that of Ewing (1939), recognizes these acarions as belonging to the superfamily Tarsonemoidea which is equivalent to the suborder Heterostigmata of some authors mentioned.

SYSTEMATIC RELATIONSHIPS

Although profound differences of opinion are rather commonly encountered among acarologists with regard to the systematic arrangement of the Acarina, most of the workers concur in the belief that, until more is known about mites in general, evaluation and establishment of characters for separation of the higher categories must of necessity be quite arbitrary.

Following the lead of such well-known early explorers in the field of acarology as Dugès, Kramer and Canestrini, Vitzthum (1943) in the latest comprehensive treatise of the order Acarina separates the group into six suborders essentially on the basis of the arrangement of the tracheal system. This character appears to be a conservative one and hence worthy for high category differentiation; and with the exception of some confusion being encountered relative to the difficulty of observing the character distinctly, particularly by earlier workers who were hindered by poor preparations and optical equipment, it segregates the Acarina into well-defined groups.

Some of the early workers following the classification based upon the tracheal system, due to inaccurate observations, erroneously placed the tarsonemid mites in the suborder Sarcoptiformes, which was characterized as having no tracheal openings. This error was made by Kramer and subsequently by Banks, Berlese and Ewing. The correct interpretation of the character was made by Vitzthum as indicated by his placement of the group in the suborder Trombidiformes (Reuter, 1909) including those mites with one pair of tracheal openings in the anterior portion of the body.

Within the suborder Trombidiformes appears a large array of small, oval or flattened mites with a smooth, shining cuticle often showing traces of segmentation, further characterized by the presence of a pair of clavate sense organs or pseudostigmatic organs (with a few exceptions) situated dorsolaterally between coxae I and II in adult females; mouth parts of both sexes consist of stout palpi, except in highly specialized parasitic species, and styliform chelicerae. These characters appear to refute the claims made by some workers for close relationship to the Sarcoptiformes, which superficially they resemble in general appearance. The latter suborder not only lacks stigmatal openings, but the mouth parts consist of stout, paired palpi and stout, chelate chelicerae which are never enclosed in an oral tube. Some sarcoptiform mites possess on the posterior dorsal region of the propodosma a pair of pseudostigmatic spines of variable structure which have been homologized with the pseudostigmatic organs of the tarsonemoid groups, an obvious misinterpretation of the structures involved in the opinion of the present author. Many sarcoptiform mites further are characterized by the presence of genital suckers which are never present in the tarsonemoid groups. Both groups are characterized by indications of body segmentation beyond the frequent acarinen condition of distinct segmentation between the propodosoma and hysterosoma.

Until more information is available concerning biologies of the species in the two groups, little can be offered in the way of comparison. Biologies of the Tarsonemidae are discussed in a section of this paper which follows, but aside from a few species in other tarsonemoid groups relatively little is known regarding this phase of comparison. Many sarcoptiform and tarsonemoid species are found in close association with one another but direct comparison or contrast of the biologies of these controversial groups cannot be made by this author at the present time.

Although Ewing (1939) felt that the family Tarsonemidae as defined by this writer was only of subfamily rank it is the author's

opinion that Vitzthum (1943) correctly recognized the group as one of sufficient distinctness to be re-elevated to family rank. In Ewing's classification the superfamily Tarsonemoidea (Heterostigmata of some authors) contained three families, namely, Disparipedidae, Pediculoididae and Tarsonemidae. The last family was further subdivided into three subfamilies namely, Tarsopolipinae, Podapolipinae and Tarsoneminae. The subfamily Tarsoneminae was restricted to include three genera, *Pseudotarsonemoides* Vitzthum, *Hemitarsonemus* Ewing and *Tarsonemus* Canestrini and Fanzago. Vitzthum (1943) recognized four families in the cohort Tarsonemini, namely, Scutacaridae, Pyemotidae, Tarsonemidae and Podapolipodidae. In the family Tarsonemidae the latter author placed the genera *Tarsonemus* C. & F., *Tarsonemoides* Trågårdh, *Acarapis* Hirst, *Avrosia* Oudemans and *Microdispodides* Vitzthum. This writer, as indicated above, agrees with Vitzthum in his recognition of the heirarchical status of the family as well as in the distinction of the other three families; however, this writer would make the following changes in the classification as presented by Vitzthum: some genera recognized by Vitzthum in the Tarsonemidae should be relegated to other families; Ewing's subfamily Tarsopolipinae should be elevated to family rank, the Tarsopolipodidae; Trågårdh's genus *Tarsonemoides*, Vitzthum's *Microdispodides* and *Pseudotarsonemoides* all appear to belong to the family Scutacaridae; of the other genera included by Vitzthum in the Tarsonemidae, Hirst's *Acarapis* and *Tarsonemella* both should be placed in the Tarsopolipodidae and Oudemans's genus *Avrosia* relegated to some other family, probably one in the sarcoptiform group. This grouping would restrict the family Tarsonemidae as characterized in the section on taxonomy which appears later in this paper and would include two of the genera included in the group by Ewing and Vitzthum, namely *Tarsonemus* (which was included by both authors), and *Hemitarsonemus* (included by Ewing).

Relationships of these families to one another is obscure since so little is known concerning morphology, distribution and bionomics of the included species. Such relationships are at best a matter of almost complete conjecture. In general morphological characters and to some degree in bionomics the species included in the family Tarsonemidae very closely resemble the members of the family Scutacaridae. In the family Scutacaridae the cephalothoracic shield is prolonged concealing the capitulum, a condition approached in the genus *Hemitarsonemus*; body segmentation is conspicuous as in most of the Tarsonemidae; the fourth pair of legs

in the females of some species have reduced segmentation and terminal setae as in the Tarsonemidae. Some of the highly specialized parasitic species of the Scutacaridae lack pseudostigmatic organs and possess two pairs of anterior stigmatal openings which differ considerably from the Tarsonemidae. In both families sexual dimorphism is marked.

The family Pyemotidae (= Pediculoididae) probably is less closely related to the Tarsonemidae as evidenced by the ovoviviparous method of reproduction and the morphological similarity of female legs IV to the other legs.

It is possible that the Tarsopolipodidae should be included in the Scutacaridae. Vitzthum (1943) included the genus *Acarophenax* in the family Pyemotidae, but Hughes (1948) declares that this genus appears to her to have a greater affinity to the Scutacaridae. The present author will withhold conjecturing on the generic inclusions of these related families due to the fact that a sufficient number of specimens has not been studied.

EXTERNAL MORPHOLOGY AND TERMINOLOGY

(Plates 1 and 2)

Tarsonemid mites are very small, ranging in length from one tenth to one third of a millimeter. The integument is relatively hard in the mature forms and has a shiny surface. The body is rather sparsely beset with setae as are the hind appendages. The anterior pairs of legs, especially their terminal segments, are more densely clothed with setae and often are equipped with specialized sensory setae of various configurations and sizes.

Pronounced sexual dimorphism is characteristic. The males are not only much smaller in size than females of the same species, but the general body contour is markedly different. In the female the usual condition is an ovoid body shape with the anterior pairs of legs separated from the posterior pairs by a distinct interval and the dorsum of the body convex. A group of species in the genus *Steneotarsonemus* has apparently undergone much modification in respect to general body contour, no doubt related to the adaptation for their particular habitats. Females of these species are quite elongate, with the anterior and posterior pairs of legs widely separated. In addition, the mites of both sexes are dorso-ventrally depressed which is indeed a configuration quite suitable for their activities in the confined spaces between the sheaths and stems of the grasslike hosts. In the genus *Hemitarsonemus* extreme

convexity of the female dorsum is characteristic, the carapacelike dorsal idiosoma concealing from above the capitulum (in living specimens). This condition is approached in some of the species of *Tarsonemus*.

The body of a tarsonemid mite is divided into three well-defined portions and may be further divided by the use of established terminology as defined below. The mouthparts are contained in a distinct capsular head called the capitulum. The remainder of the body comprises the idiosoma which is transected by a definite and distinct suture, called the main body suture, between the anterior and posterior pairs of legs. The unsegmented area anterior to the main body suture is called the propodosoma and the portion of the idiosoma behind the main body suture is the hysterosoma. The propodosoma is a single, more or less continuous body region, which in some species has the dorsum prolonged anteriorly forming what is called a cephalothoracic or rostral shield which is sometimes separated from the remainder of the dorsal propodosoma by a suture. Such a prolongation or forward extension of the dorsum of the propodosoma, which occurs in many families of mites, has also been designated by various authors as the cephalothoracic hood or rostral hood. The hysterosoma may be further divided into anterior and posterior portions or that portion from the main body suture to the hind margins of coxae IV and the portion behind the legs. Names applied to these two regions of the hysterosoma are the metapodosoma and the opisthosoma, for the anterior and posterior portions respectively.

The mouth parts consist of stout, paired palpi of indistinct segmentation inserted on the apical portion of the capitulum, and slender, styliform, paired chelicerae the bases of which are inserted just medial to the bases of the palpi. In the genus *Rhynchotarsonemus* the palpi are extremely elongate, projecting forward to such an extent as to appear in the form of a snout. Situated medially and internally in the capitulum are paired, tubelike structures which are referred to in this paper as cheliceral sheaths. This terminology has been adapted because of the apparent function of the structures in enclosing the chelicerae when the latter are retracted. There remains the possibility that these structures serve an entirely different function, however.

Tarsonemids are characterized by the pronounced development of apodemes on the ventral portion of the body. Certain authors refer to these characters as epimera, but it is felt by the present

writer that such reference is in error. There appears to be insufficient association with the coxal segments to be correctly called epimera, and if the structures were epimera the presence of an extended median structure would not be expected. Further studies on the morphology and internal anatomy will no doubt clarify this interpretation. The apodemes have been designated by the present writer as follows: apodemes I, which have their anterolateral termina in the region of the anterior margins of coxae I; apodemes II, which have their anterolateral termina in the region of the anterior margins of coxae II; anterior median apodeme, which is medial in position on the propodosoma; transverse apodeme, which is associated with the main body suture; apodemes III, which terminate posterolaterally in the region of the anterior extremities of coxae III; apodemes IV, which terminate posteriorly near coxae IV; posterior median apodeme which occupies a median longitudinal position on the metapodosoma.

The males are equipped caudally with a rather unique structure which Ewing and other authors refer to as the genital papilla. Actually the structure is more accurately described as a genital plate. However, this author has followed the established terminology in this instance. The papilla is situated terminally on the opisthosoma in living specimens (see Plate 2) but in microslide preparations it usually tilts to appear in a dorsal position with the dorsal margin thus appearing as the anterior margin and the ventral margin projecting caudad beyond the apex of the opisthosoma. It contains within its clearly defined limits the paired, styliform aedeagi as well as other accessory genital organs and appendages, the exact identity of which are as yet unknown. Another structure, referred to in this paper as the anal plate is often quite conspicuous in slide-mounted specimens. Its position in living males is subterminal on the ventral opisthosoma just anterior to the ventral margin of the genital papilla, although in microslide mounts this normal position is not often apparent. The plate is lacking in clearly defined lateral limitations, the most conspicuous portion of the structure being a central disc or apertures from which fingerlike apodemes radiate. The usual number of anal apodemes is three, two of which extend anterolaterally for a short distance from the anterolateral margins of the disc and the third projecting caudally from the posteromesal margin of the disc. However, in some species there may be four anal apodemes, two projecting from the anterior margin of the disc and two from the posterior margin, and one species has one apo-

deme projecting forward from the disc and two projecting caudad.

Females are characterized by the possession of specialized organs located dorsolaterally between coxae I and II. These organs, which vary somewhat in size and shape (see Plate 2), are of uncertain function and have been called clavate sense organs or pseudostigmatic organs by various workers. The term pseudostigmatic organs is used by the present writer although the applicability of this name is questionable. Probably these paired structures are highly modified sensilla trichodea and are more properly referred to as specialized sense organs, since they seem to have no relationship to the tracheal system.

There appears to be little or no evidence of a tracheal system in the males of tarsonemid mites. However, as methods of preparing specimens are refined and improvements are made on optical instruments, new light may be shed on this interpretation. In the females of the group the stigmatal or tracheal openings are quite distinct, being situated dorsolaterally near the anterior margin of the propodosoma. From these external orifices extend the tracheae which converge medially in the region of legs II, diverging posteriorly from this point, disappearing inconspicuously in the opisthosomal region. In some species the tracheae connect with paired, heavily sclerotized, elongated structures situated medially near the point of convergence of the tracheae or in subspheroidal, dilated pouches similarly situated. These structures are probably atria (see Plate 2). It is obvious at this point that there is much need for further studies on the internal anatomy of the mites in this family.

Classification of the family Tarsonemidae has been based largely upon characters of the hind pair of legs of the males, this being a logical method of separation because of the variability of these appendages. Legs IV of the males may be regarded as accessory copulatory appendages because of their function in premating behavior and the mating process. It appears that these appendages are highly modified in various ways presumably representing adaptations developed for better performance of these functions. A plastic character such as this lends itself well in distinguishing the lower categories. In general, legs IV of the male are four-segmented, but in some species a fusion of the tibia and tarsus has reduced the segmentation. We may assume that this represents, in this single character, specialization by reduction. Likewise, the terminal claw of these appendages varies considerably from the condition of prominence to that of nearly complete degeneration.

Modifications of the femur are quite evident in some species groups, ranging from a thin, membranelike, inner flange to a spurlike projection of the inner margin. This type of specialization is probably related to the requirements of the various species in the copulatory process, for this pair of legs functions only passively in locomotion. The individual setae of this pair of appendages have been named by Ewing which facilitates reference to them, but since setae of other appendages are not so named this writer has not followed Ewing's nomenclature for the chaetotaxy of the male leg IV.

In descriptions of species which follow in this paper most of the body setae are identified by size, shape, and location. There are several types of specialized setae ranging from the normal condition, which is that of a rather narrow base from which the seta tapers to a threadlike apex, to modified types which may appear clavate, lanceolate, peglike, or of various other shapes. Leg segments are referred to by name except in cases where names cannot be applied with any degree of certainty due to a lack of knowledge of the homologies involved. Many acarologists prefer to follow the numerical system of identifying leg segments; but under this system, in instances of reduced number of segments, the place of reduction is not identified and the resulting lack of homology confuses the picture.

Chaetotaxy of the legs is described on the basis of normal orientation of the mite on a microslide. This position is with legs I and II extending forward and the posterior pairs extending to the rear. By reference to this "normal" position the geographic location of the seta is readily and easily indicated by the simple statement of dorsal or ventral position with further indication stated in terms of the outer or inner margin of the segment, that is the margin away from or close to a hypothetical line bisecting the mite along the longitudinal axis, respectively.

There is considerable need for standardization of terminology in the entire field of acarology, and it appears that this need will be satisfied only after further studies have been made on the various groups, so that homologies of structures as well as proper identity or interpretation can be made.

GEOGRAPHICAL DISTRIBUTION

Because of the paucity of specimens of the family Tarsonemidae in collections, little can be said about the geographic distribution of the group. From information which may be gleaned from studies of available material and from published reports, it seems that the family is predominantly a tropical or subtropical one.

Tarsonemids have been reported from all of the major zoogeographical regions of the world and range over a diversity of climatic conditions. One species has been reliably reported from Europe, Asia and North America, another is found commonly in Europe and North America and probably occurs elsewhere. Still another species has been taken in Australia, Hawaii and North America. However, large collections of mites taken in the Arctic have contained no tarsonemids. Until more areas are collected for these mites it will remain impossible to correlate distributional data with the possible place of origin of the group or to integrate distribution into a solution of the problem of relationships within the family.

BIONOMICS

With the exception of two species, comprehensive biological studies have not been conducted on tarsonemid mites. Garman (1917), Mozzette (1917), Massee (1933) and Smith and Goldsmith (1936) published information obtained from biological studies of *Steneotarsonemus pallidus* (= *Tarsonemus pallidus*). Cameron (1925) successfully reared and reported the results of biological studies of *Hemitarsonemus latus*. The present writer conducted some rather limited investigations into the bionomics of a few species, the results of which are recorded in the discussion which follows.

All tarsonemid mites thus far studied have four distinct stages in their life history. Eggs are laid singly by the gravid female. They are white, ovoid, opaque, and large in comparison to the size of the adult. In some species the smooth surface is dotted with small, tubercular swellings and others have the surface broken by numerous pitlike depressions. The egg hatches into the six-legged larva which is white, opaque with the two anterior pairs of legs situated as in the adult, the posterior pair in the position of legs III of the adult. Larvae are further characterized by the presence of a peculiar enlargement of the opisthosoma into a triangular plate-like development which is most prominent in males. Larvae of males are considerably smaller than female larvae. From this active stage the mites of both sexes enter a quiescent "pupal" stage in which transformation to the adult takes place. This stage is sessile and the larval integument appears inflated or bloated with the cuticle tightly stretched. Transformation to the adult takes place within the larval skin through the successive stages of withdrawing the appendages from the old integument and formation of legs IV behind legs III as well as development of genitalic struc-

tures. The pupal skin splits dorsally at the completion of the transformation to the adult and the mature individual emerges. Usually the integument darkens somewhat following emergence. Sexual dimorphism is pronounced in all members of the family Tarsonemidae. Males, in general, are about two thirds as large as females.

The color of many species seems to vary according to the food ingested. Some of the phytophagous species are commonly green; fungivorous species may assume a body color comparable to the color of the fungus upon which they have been feeding. Thus it appears that body color generally is not a reliable diagnostic character.

Locomotion by females is accomplished by the use of all four pairs of legs. The mites walk on the ventral subterminal setae of legs IV. In the males the hind legs are rarely used in locomotion, most frequently being carried in a semierect position above and behind the body. These appendages are invariably used by the males in transporting "pupae" and adult females both of which are carried on the male's back near the cauda in the grip of legs IV and fastened to the male by structures or appendages of the genital papilla. Larvae have never been observed by this writer nor reported by other investigators as being carried by males. Female "pupae" which are nearly mature are more frequently the portage than are adult females. Males have been observed by this writer carrying male "pupae," although this appears to be unusual. The present writer also observed males of *Tarsonemus setifer* carrying "pupae" of *T. pritchardi*.

Parthenogenesis is common, but there appears to be some difference of opinion concerning the type of progeny resulting from this type of reproduction. Garman (1917) offers conclusive evidence that offspring of *Steneotarsonemus pallidus* resulting from parthenogenetic reproduction are invariably females, having successfully reared this species through several generations without the appearance of males. Gadd (1946) in rearing *Hemitarsonemus latus* found that unfertilized eggs of this species produced only males. The present writer in rearing *Tarsonemus randsi* and *T. setifer* found the results of parthenogenesis to be the same as that reported by Gadd.

Optimum environmental conditions for the various species studied appear to involve a combination of warm temperatures, high humidity and low light intensity. Tarsonemid mites are known to survive in the adult stage through prolonged exposure to freezing

temperatures but seem sensitive to temperatures above 35° C. Garman (1917) reports that a relative humidity of from eighty to ninety percent is optimum for *S. pallidus*.

There is some indication of the existence of a correlation between hosts and the taxonomic units established in this paper. In the genus *Steneotarsonemus*, four of the ten described species feed upon grasses or grasslike plants. Of the remaining six species three feed on other monocotyledonous plants. *S. ananas* is restricted in its host selection to pineapple which is a member of the plant family Bromeliaceae and which, although it is a monocotyledonous plant, bears no close relationship to the Graminae. The scant evidence available suggests banana as a possible host of *S. latipes*, this plant also being a monocotyledon in the family Musaceae. *S. laticeps* apparently feeds only on plants in the family Amaryllidaceae. Two of the remaining species in the genus, namely, *S. pallidus*, and *S. fulgens*, apparently feed on dicotyledonous plant species. *S. chionaspivorus* is recorded as predatory, but the present writer feels that it is a fungivorous species. The unusual biological characteristic of *S. ananas*, together with certain morphological inconsistencies set this species apart somewhat from other members of the genus.

The two members of the genus *Hemitarsonemus* about which host relationships are known are phytophagous, one being relatively host specific to ferns, the other a general plant feeder. The third species has yet to be studied in this regard, its food habits being unknown at the present time.

The single species in the genus *Xenotarsonemus* is probably phytophagous, although conclusive evidence has yet to be presented in this regard. Likewise, the host relationships of the single species in *Rhynchotarsonemus* are not clearly understood, although this writer reared several generations on cultures of combinations of algae and fungus. The entire complement of the genus *Tarsonemus* is probably fungivorous.

Natural enemies of tarsonemid mites have occasionally been reported by other workers. Bianchi (1940) reported *Podothrips lucasseni* as predaceous on *S. ananas* in Hawaii. Natural enemies observed by this writer include members of two predaceous mite families, namely, the Cheyletidae and the Phytoseiidae. Smith and Goldsmith (1936) report the predatory phytoseiid, *Seiulus* sp., as responsible for considerable depredation in populations of the cyclamen mite. McGregor (1944) reports *Cheyletogenes ornatus* as a predator of *Tarsonemus setifer* in southern California. Because of the very small size of tarsonemid mites and their sequestered habits, they usually escape the ravages of predators.

ECONOMIC IMPORTANCE AND CONTROL

The first definite record of tarsonemid damage to an agricultural crop seems to have been that made by Bancroft in 1877 in which *Steneotarsonemus bancrofti* was noted as a pest of sugarcane in Queensland. In 1878 Targioni-Tozetta reported *Tarsonemus oryzae* as a pest of rice in Italy. Since these early records numerous other species of tarsonemid mites have been incriminated as agricultural pests, some were recognized as parasites of scale insects, others were suspected as having a parasitic relationship to higher animals including man and some were indicated as fungus feeders. Most of these records of host relationship, in the opinion of this writer, should be investigated further.

The species of undisputed agricultural significance include *Tarsonemus randsi*, *Steneotarsonemus spirifex*, *S. bancrofti*, *S. laticeps*, *S. phyllophorus*, *S. ananas*, *S. pallidus*, *Hemitarsonemus latus* and *H. tepidariorum*. Mackenzie (1922) and Hirst (1922) reported the finding of *T. floricolus* in human urine and the former author presents rather convincing evidence that this species did not occur as an accidental contaminant; three case histories are cited in support of a conclusion that *T. floricolus* is a direct cause of human suffering due to the effects of mites invading the urinary system of man.

Tarsonemus affinis was reported by Harada (1925) as a possible parasite of man, being found in human urine, however, the possibility of external contamination of the urine sample was never completely eliminated. In spite of the Mackenzie report, the present author finds the incrimination of tarsonemid mites as internal parasites of man untenable. The morphology of these mites is such that burrowing through membranes is improbable if not impossible and it is likewise inconceivable that the invaders could gain access to a human bladder in any other manner except, perhaps, under extremely extraordinary circumstances such as perverse behavior by the invaded person. Dahl (1910) mentioned a possible relationship between *Tarsonemus sauli* and horses. Oudemans (1903) suggested a possible host-parasite relationship between *T. soricicola* and shrews.

Of the economic species mentioned above it is generally considered that *Steneotarsonemus pallidus* causes the greatest amount of damage followed closely by *Hemitarsonemus latus*. Both of these species have enormous host ranges which include many commercially grown crop plants, and as a consequence these species have been studied rather intensively both from the biological and control

standpoints. *Tarsonemus randsi* is a pest of considerable importance in the commercial growing of mushrooms, and also may be quite destructive in its invasions of fungus cultures in research laboratories. Other species in the genus *Tarsonemus* have also been found in laboratory fungus cultures and control of such invaders without damaging the fungi or culture media has been the subject of several published reports (Carpenter, 1914; Jewson and Tattersfield, 1922; Shafik and Page, 1930; Puntoni, 1931; Barnes, 1933; Page and Shafik, 1936; Hansen and Snyder, 1939; Crowell, 1941; Snyder and Hansen, 1946.).

Control of tarsonemid mites has long defied all efforts of numerous workers to obtain a satisfactory solution. Chemical controls directed against infestations have included nicotine solutions, lime-sulfur, sodium selenate, oil emulsions, sulfur dusts, naphthalene and calcium cyanide fumigation and others, all with varying reports of success and failure. Other methods of control recommended included hot water immersion and heat treatment (Smith and Goldsmith, 1936). More recent recommendations for tarsonemid mite control include methyl bromide fumigation (Breakey, 1943; van Marle, 1944), although Richardson et al (1943) mention resistance of *S. pallidus* to this fumigant, "lorol" thiocyanate sprays (Goodhue and Smith, 1944), di(p-chlorophenyl) methyl carbinol (Pritchard and Beer, 1949a), parathion (Pritchard and Beer, 1949b) aramite or 2-(p-tert-butylphenoxy) isopropyl 2-chloroethyl sulfite, toxaphene and malathion or S-(1,2-dicarbethoxyethyl) 0,0-dimethyl dithiophosphate (Pritchard, 1951). Further screening tests on chemical control of the cyclamen mite (Pritchard, 1951a) indicate that toxaphene sprays provide effective control with a minimum of plant injury. Sprays using from one to two quarts of sixty percent emulsion concentrate per one hundred gallons of water applied under greenhouse conditions with a repeat application seven days following the first spraying resulted in one hundred percent control of the mites on heavily infested ivy plants in tests conducted by the present author. At the heavier dosage, with one percent oil included, the foliage of stephanotis and gardenia plants was injured somewhat in plant tolerance tests. At the lighter dosage foliage of cyclamen and blooms of saintpaulia showed spray damage.

To summarize the control of tarsonemid mites, the following are effective methods of eliminating or minimizing infestations: hot water treatment of sugarcane cuttings and new planting stock of strawberries to prevent introduction of *Stencotarsonemus bancrofti*

and *S. pallidus* respectively; spraying with di(p-chlorophenyl) methyl carbinol, malathion, parathion or toxaphene within the limits of plant tolerance and at concentrations known to be lethal to the mites; methyl bromide fumigation of nonsensitive, infested plants. Repeat applications of acaricidal sprays are often necessary in order to obtain coverage of leaf surfaces inaccessible at the time of the first application.

Artificial controls have never been directed against such species as *Tarsonemus oryzae* infestations on oats and rice nor against *Steneotarsonemus spirifex* on corn, oats and other grains, probably due to the fact that the economics involved in margin of profit of such crops precludes application of extensive and perhaps questionable controls. Infestations of *Tarsonemus randsi* in fungus cultures in research laboratories of plant pathology were treated, under this author's observations, with pyridine, in concentrations recommended by Jewson and Tattersfield (1922) for the control of other mite species causing damage to such cultures, with no success. A period of seventy-two hours exposure of the agar slant cultures to an atmosphere of pyridine in a hermetically sealed container proved lethal to the fungus and resulted in less than a fifty percent mortality in the mite population. Tarsonemid mites are extremely resistant to even the most severe treatment with the usual acaricides. Most species will survive a two hour submergence in water. On the other hand they appear to succumb readily to mild heat or desiccation.

COLLECTION AND PREPARATION

Tarsonemid mites, because of their extremely small size, are most easily collected by examining various suspected materials in the laboratory under a dissecting microscope. Such items as tree bark, twigs, fruit, roots, stolons, leaves, flowers and the like may harbor tarsonemids, which to most observers will be invisible to the naked eye. These may be picked off the substrate on a single-haired brush or with a micro-needle and transferred to alcohol. Ninety-five percent alcohol is used in collecting bottles because of the advantage offered by its low surface tension; mites quickly fall from the brush or needle into this preservative. At times these mites may be successfully collected in quantity by enclosing plant material in a wide-mouthed container over the top of which a piece of porous paper has been secured tightly. As the plant material desiccates the mites wander to the top of the container. This porous paper top may be removed from time to time and examined for mites

under a low power microscope. Tarsonemid mites may also be collected by the Berlese funnel technique. This writer prefers to collect tarsonemid mites wherever possible by some method employing individual picking rather than a mass washing type of process. The reason for this is that dirt and other foreign objects are difficult to remove from a tarsonemid and because of the small size of the mites even a very tiny artifact may completely ruin the prepared specimen.

The most satisfactory mounting medium, in this writer's opinion, is polyvinyl alcohol with lactic acid and phenol added according to the formula given below. Various recipes for Berlese media have been tried but most of these crystallize in a relatively short time. The formula for the Berlese mounting medium found most satisfactory by the author is also given below. Because of the probable nonpermanent nature of these media some preparations have been made in various of the recognized permanent media, such as hyrax and balsam.

In preparing a PVA-L-P mount the mite is removed from alcohol and heated gently in lacto-phenol clearing solution, the recipe for which is given below, until cleared. Transfer is made directly from the clearing solution to a slide containing a drop of PVA-L-P. The mite is submerged in the mounting medium and the cover slip put in place. Gentle heat such as that imparted by placing the slide for two or three minutes on the metal shade of a gooseneck lamp is then applied. Care must be taken to avoid using too much mounting medium or the legs and capitulum may come to rest in a semi-vertical plane in which case characters are obscured. An insufficient quantity of medium on the slide may result in too much crushing of the specimen or withdrawing of the medium from the edges of the cover slip as the PVA-L-P dries. Mites may be placed alive or directly from alcohol into PVA-L-P, the cover slip put in place, mild heat applied for a short time and excellent preparations result, due to the clearing action of the lactic acid and phenol in the medium. Preliminary clearing as a general rule results in better mounts, however. (See Lipovsky, 1953.)

For Berlese mounts, specimens are removed from alcohol, placed directly in a drop of Berlese medium on the slide, the cover slip then put in place and mild heat applied, with excellent preparations resulting. Such slides should be watched carefully for signs of crystallization, which usually become evident first near the edges of the cover slip. If this occurs the specimens should be remounted. Re-

mounting from Berlese is a simple process, the cover slip being removed easily after soaking the slide for a time in warm water.

Balsam mounts have been prepared by this writer by removing specimens from ninety-five percent alcohol and soaking them for twenty-four hours in methyl cellosolve. From this solvent they are moved directly to balsam and the cover slip applied. Without the intervention of methyl cellosolve the body and especially the legs often collapse. Successive steps through the higher alcohols to xylol or clove oil also frequently resulted in collapsed or partially collapsed specimens.

Hyrax mounts involve considerable time in preparation, but excellent preparations may be just reward for the effort involved. The technique described by Newell (1947) with certain modifications is the one followed by this writer. Specimens are cleared thoroughly in lacto-phenol solution followed by further clearing in KOH. After washing in water the cleared specimens are run through the alcohols to absolute alcohol. The mites are then floated in alcohol on top of a tube of alpha-chloronaphthalene. In an oven adjusted to about fifty degrees centigrade the absolute alcohol evaporates and the specimens infiltrate into the alpha-chloronaphthalene. After a few days in "acn" the mites are transferred to a drop of hyrax mounting medium on a slide, submerged and the cover slip applied. From the beginning of the clearing process to the stage of transferral of the specimen to the hyrax, specimens are handled only in a pipette. The final transfer to the slide is made by picking the specimen out of the acn on a micro needle and placing it in the hyrax. Specimens mounted in hyrax, which has a rather high refractive index, show some advantages over specimens mounted in some of the other "permanent" media such as balsam which have a lower index of refraction.

This writer, as a matter of policy, rings all slides with Zutt's ring-compound. The reason for this is twofold: oxidation, excessive dehydration and crystallization of the various media are delayed; also, slides are more easily maintained in a clean and neat condition if ringed, particularly following examination under oil. For further information on mounting techniques, particularly the placing of labels and the like, the reader is referred to Hood's (1947) manual.

MOUNTING MATERIALS

Hydrax (Newell, 1947), modified by present writer

Clear with digesting solution: (0.2 gm. trypsin powder in 10 cc. 0.5% Na₂CO₃, filtered after standing for several hours in toluene atmosphere.)

Wash specimen with water, then dehydrate with alcohols.

Specimen in absolute alcohol poured into tube containing alpha-chloronaphthalene; oven at 40° C.

From acn to hydrax dissolved in acn (mountant) after infiltration of specimen by acn is complete (alcohol completely evaporated).

PVA-L-P (Downs, 1943)

Water	50 cc.
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DuPont "Elvanol"

Add to water slowly until thick paste forms and powder no longer moistens quickly.

Lactic acid	22 cc.
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Phenol crystals	22 cc.
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Add to lactic acid and dissolve before adding this mixture to "Elvanol" paste.

("Elvanol"—Low viscosity—Type B—Grades 70-05 and 90-25 have been used successfully by the present writer.)

PVA-L-P (Jones modification)

PVA (In 250 cc. flask)	6.3 gms.
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Absolute alcohol saturated with picric acid	18 cc.
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Add to flask and stir to paste.

Lacto-phenol	45 cc.
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Add to flask and heat mixture in water bath until clear. (This mixture permits staining in mounting medium.)

Hoyer's Solution (A modified Berlese mounting medium)

Water	50 cc.
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Gum Arabic (clear crystals)	30 gms.
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Chloral hydrate	200 gms.
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Glycerine	20 cc.
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(Mix at room temperature in above sequence; mount directly from life, water or alcohol.)

C-M Medium (Clark and Morishita, 1950)

Methocellulose ("Methocel": Vernol Chemical Co.)	5 gms.
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Carbowax 4,000 (Carbide and Chemical Corp.)	2 gms.
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Diethylene glycol	1 cc.
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Ethyl alcohol, 95%	25 cc.
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Lactic acid	100 cc.
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Distilled water	75 cc.
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(Mix 1 and 4; add to others; filter through glass wool. Oven 40-45° C 4-5 days. Thin if necessary with 4. Mount directly from alcohol, lactic acid or cellusolve.)

Lacto-Phenol Clearing Solution

Lactic acid	50 cc.
Phenol crystals	25 cc.
(Add to lactic acid to bring total volume to 75 cc.)	
Distilled water	25 cc.

TAXONOMY

Until mites belonging to the family Tarsonemidae have been collected in sufficient numbers from as many different geographical locations and ecological situations as possible, the author feels that evaluation of characters in phylogenetic studies or even in group definition is impossible. It is felt that complete and accurate descriptions of all known species, even though such descriptions may be exceedingly prolix, is the only solution for determining the conservativeness or plasticity of morphological characters. Most descriptions of new species of tarsonemid mites have been entirely inadequate for the purposes of comparison with known species. To add to the confusion in the group, European workers have cared little for and regarded less the work of American acarologists with the family Tarsonemidae and vice versa. From time to time in the past attempts have been made to integrate the European and American studies, not only with this family but also with other acarien groups. Reconciliation was finally made between the two names, *Tarsonemus pallidus* Banks and *T. fragariae* Zimmerman, as well as between a few other species. However, until the family Tarsonemidae is much better known it seems advisable to describe species in minute detail in order to facilitate comparison of species by workers in other parts of the world.

Much type material has not been available to the author for study to date, and as a result the validity and often the proper taxonomic position of certain species cannot be decided with certainty. In such instances the best reference available for the species is cited and the species in question is discussed in a position in this paper showing its proper relationship, with opinions of the present author freely expressed in this regard.

Thus, this paper is an attempt to solidify the status of a few of the described species of tarsonemid mites and to leave the remaining species with their position in the taxonomic picture subject to change after further studies have been made.

Throughout the family Tarsonemidae there exists a great morphological similarity among females which complicates the problem of segregation at the generic level when this sex alone is considered. However, it is obvious that the present writer is convinced that the family is divisible into distinct generic units on the basis of male characters. Owing to the fact that females present this somewhat confusing problem, a key to assist in identifying Western Hemisphere species is appended to the present paper in which the entire complement of the family in this region is considered without regard to generic segregation (see Addendum, p. 1321).

On the basis of some rather intangible morphological characters discernible in the group, the genus *Tarsonemus* appears to be divisible into two groups. One of these groups, referred to in this paper as the Setifer Group, includes nine species, namely, *T. setifer*, *T. occidentalis*, *T. smithi*, *T. randsi*, *T. cryptocephalus*, *T. laminifer*, *T. sulcatus*, and possibly *T. dispar* and *T. truncatus*. The other group, referred to as the Confusus Group, appears to include the remaining species in the genus. The distinction between these groups at the present writing is not sufficiently concise to permit consideration of subgeneric separation but it is conceivable that such a classification may develop as studies progress.

DESCRIPTION OF THE FAMILY TARSONEMIDAE

Small mites with shining integument; capitulum capsular bearing apically paired, simple palpi, the chelicerae styliform; idiosoma distinctly divided into propodosoma and hysterosoma, further segmentation of hysterosoma indicated particularly in female; one pair of pseudostigmatic organs located dorsolaterally between legs I and II of female, this sex with one pair of tracheal openings located anterodorsally on propodosoma, male without either pseudostigmatic organs or tracheal openings; both sexes with single claw on front legs, two claws on legs II and III; leg IV of female four-segmented, terminal segment with two long setae and without claws; legs IV of male often highly modified as accessory sexual appendages, with three or four segments, with or without terminal claw; male with a large genital papilla situated at apex of hysterosoma.

Type genus: *Tarsonemus* Canestrini and Fanzago (by original designation of Kramer, 1877).

KEY TO THE GENERA OF THE FAMILY TARSONEMIDAE

1. Palpi of both sexes prolonged anteriorly forming an elongate beak *Rhynchotarsonemus*, p. 1221
 Palpi of both sexes projecting slightly beyond apex of capitulum but never forming an elongate beak 2
2. Males without claws, empodia or knoblike arolia on tips of legs IV *Xenotarsonemus*, p. 1314
 Males with legs IV terminating in a claw or a knoblike pretarsal element 3
3. Males with body laterally compressed; tibia and tarsus or tibiotarsus IV slender, elongate, more than three times as long as basal width of tibia or tibiotarsus *Hemitarsonemus*, p. 1291
 Males with body dorsoventrally depressed; tibia and tarsus or tibiotarsus IV at most two and one-half times as long as basal width of tibia or tibiotarsus 4
4. Males with large, flangelike expansion on inner margin of femur IV or if absent then fourth dorsal propodosomal seta in linear arrangement with setae of three preceding pairs or capitulum broader than long *Stenotarsonemus*, p. 1230
 Males with inner flange on femur IV absent or greatly reduced in size; fourth dorsal propodosomal seta always laterad from third seta or capitulum longer than broad *Tarsonemus*, p. 1114

Genus *Tarsonemus* Canestrini and Fanzago

Tarsonemus Canestrini and Fanzago, 1876, Atti Soc. Veneto-Trentina Sci. Nat., Padova, vol. 5, p. 142; Kramer, 1877, Arch. für Naturgesch., vol. 43, no. 1, p. 215; Canestrini and Berlese, 1884, Atti della Società Veneto-Trentina, vol. 9; Canestrini, 1888, Prospeto dell' acarofauna Italiana Padova, vol. 3, p. 313; Berlese, 1894, Acari, Myriapoda et Scorpiones hucusque in Italia reperta, fasc. 75, no. 1-2; Sicher and Leonardi, 1894, Bull. Soc. Veneto-Trentina Sci. Nat., vol. 5, p. 183; Banks, 1899, Proc. Ent. Soc. Washington, vol. 4, p. 294; Banks, 1904, Jour. Roy. Agr. Soc. England, vol. 65, p. 273; Ewing, 1911, Psyche, vol. 18, no. 1, p. 37; Banks, 1912, Proc. Ent. Soc. Washington, vol. 14, p. 96; Quayle, 1912, California Agr. Exp. Sta. Bull., 234, p. 503; Quaintance, 1912, U. S. Dept. Agr., Bur. Ent. and Plant Quarantine, Bull. 97, pt. 6, p. 103; Rutherford, 1913, Trop. Agr. Peradeniya, vol. 41, no. 6, p. 490; Banks, 1914, Jour. Ent. and Zool., vol. 6, p. 55; Banks, 1915, U. S. Dept. Agr. Rept. 108, p. 104; Oudemans, 1915, Ent. Ber., vol. 4, p. 186; Oudemans, 1915, Arch. für Naturgesch., vol. 81, abt. A, heft 5, p. 76; Ewing, 1917, Jour. Econ. Ent., vol. 10, no. 5, p. 497; Harada, 1925, Japan Medical World Tokyo, vol. 5, no. 9, p. 251; Oudemans, 1926, Ent. Ber., vol. 7, p. 67; Oudemans, 1927, Tijdschr. voor Ent., Gravenhage, vol. 70, p. XXXV; Vitzthum, 1928, Zool. Anz., Leipzig, vol. 75, p. 281; Oudemans, 1929, Ent. Ber., vol. 7, no. 166, p. 421; Vitzthum, 1929, Tierwelt Mitteleuropas, bd. 5, lief 3, p. 40; Vitzthum, 1929, Ent. Tidskr., vol. 50, heft 2, p. 97; Ewing, 1929, Manual of external parasites, p. 36; Ewing, 1929, Proc. Ent. Soc. Washington, vol. 31, no. 2, p. 31; Puntoni, 1931, Ann. Parasit., Paris, vol. 9, no. 4, p. 359; Massee, 1933, Ann. Mag. Nat. Hist., London, vol. 11, p. 198; Oudemans, 1936, Tijdschr. voor Ent., vol. 81, p. V; Ewing, U. S. Dept. Agr. Tech. Bull., 653, p. 10; Cooreman, 1941, Bull. Mus. Hist. Nat., Belgium, vol. 17, no. 20, p. 1; McGregor, 1942, California Citrograph, vol. 27, no. 10, p. 270; Hughes, 1948, Mites associated with stored food products, London, p. 80.

Genotype: *Chironemus minusculus* Canestrini and Fanzago (by original designation).

Chironemus Canestrini and Fanzago (not Cuvier 1829, Pisces), 1876, Atti. Soc. Veneto-Trentina Sci. Nat., Padova, vol. 5, p. 110; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 10.

Monotypic genotype: *Chironemus minusculus* C. and F.

Dendroptus Kramer, 1876, Arch. für Naturgesch., vol. 42, p. 28; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 11.

Genotype: *Dendroptus kirchneri* Kramer (by original designation).

Cheylurus Trouessart, 1884, Bull. Soc. Etude Sci. d'Angers, vol. 14, p. 90; Canestrini, 1885, Prospeto dell' Acarofauna Italiana, Padova, vol. 3, p. 311; Berlese, 1894, Acari, Myriapoda et Scorpiones hucusque in Italia reperta, fasc. 75, no. 1; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 11.

Genotype: *Cheylurus socialis* Trouessart (by original designation).

This genus is characterized by a subcordate capitulum with palpi never prolonged to form snoutlike beak. Males usually with inner margins of femora IV unmodified, not produced into a flange-like enlargement nor spurlike process; tibia and tarsus or tibiotarsus IV not conspicuously incurved; leg IV always with a terminal claw; four pairs of dorsal propodosomal setae, those of fourth pair never in linear arrangement with three anterior pairs. Females with lobe-like tracheal expansions or atria usually absent or reduced in size, never bilobed; cephalothoracic shield, if developed, never projecting over more than basal half of capitulum; first pair of ventral propodosomal setae never in front of apodemes I.

Type of genus: *Chironemus minusculus* Canestrini and Fanzago (by original designation).

This genus appears to be the most primitive of the natural groups in the family. The lack of extreme specialization of the hind legs of the male, unspecialized mouth parts in both sexes and lack of specialized respiratory structures in the female are some of the characters which appear to indicate it is a group least removed basically from the ancestral type. From the scanty collection records it appears that the majority of species in this group suggest a rather general or cosmopolitan distribution. The fact that they show little host preference, all being fungus or alga feeders, tends to support this idea of their primitive nature.

The genus *Tarsonemus*, as presently defined, undoubtedly will be much larger than any of the other genera in the family. Further collecting of tarsonemid mites and the compiling of distributional data may bring to light additional useful information regarding the relationships of included species as well as the affinities of this genus with other groups in the family.

KEY TO THE MALES OF THE GENUS TARSONEMUS

1. Femur IV angulate at base 2
 Femur IV not angulate at base 5
2. Tactile seta of tibia IV much longer than femur IV,
 cryptocephalus, p. 1162
 Tactile seta of tibia IV as long as or shorter than femur IV 3
3. Dorsal seta of femur IV much longer than either of ventral setae;
 first and fourth dorsal propodosomal setae nearly of same
 size *occidentalis*, p. 1117
 Dorsal seta of femur IV with same length or shorter than longest
 ventral seta of segment; first dorsal propodosomal seta dis-
 tinctly longer than fourth 4
4. Fourth dorsal propodosomal seta distinctly longer than second
 seta; coxa IV as long as broad; claw IV slender and long,
 scaurus, p. 1213
 Fourth dorsal propodosomal seta having length approximately
 equal to second seta; coxa IV broader than long; claw IV short
 and stout *confusus*, p. 1173
5. Tactile seta of tibia IV very long, longer than leg IV 6
 Tactile seta of tibia IV never as long as leg IV, usually shorter
 than femur IV 8
6. Third dorsal propodosomal setae longer than other dorsal pro-
 podosomals; femur IV more than twice as long as greatest
 breadth *setifer*, p. 1125
 Third dorsal propodosomal setae shorter than others or with
 nearly same length as first pair; femur IV less than one and
 one-half times as long as greatest breadth 7
7. Second dorsal propodosomal setae much shorter than other dor-
 sal propodosomals; second dorsal hysterosomal setae as long
 as first dorsal hysterosomals *simplex*, p. 1188
 Second dorsal propodosomal setae with same length as setae of
 fourth pair, only slightly shorter than setae of first and third
 pairs; second dorsal hysterosomal setae shorter than first
 dorsal hysterosomals *pritchardi*, p. 1202
8. Femur IV with a small but clearly defined flange projecting from
 its inner margin 9
 Femur IV without inner flange 11
9. Flange occupying entire inner margin or distal portion of femur
 IV; dorsal seta of femur IV shorter than one or both ventral
 setae of segment 10
 Flange occupying proximal portion of femur only; dorsal seta
 of femur IV longer than ventral setae of segment *sulcatus*, p. 1155
10. Second and fourth dorsal propodosomal setae much shorter than
 other dorsal propodosomals; first three pairs of dorsal hystero-
 somal setae very long, nearly as long as third dorsal propodo-
 somals *laminifer*, p. 1169

- Second and fourth dorsal propodosomals with length subequal to setae of first pair; dorsal hysterosomal setae short, much shorter than third dorsal propodosomals... *dispar*, p. 1148
11. Third dorsal propodosomal setae very long, much longer than setae of other three pairs... 12
Third dorsal propodosomals not excessively longer than others.. 14
12. Femur IV dilated and robust, broadest at mid-segment, here with width greater than half length of segment; tactile seta of tibia IV much longer than other setae of leg IV... *smithi*, p. 1141
Femur IV broadest near base, width at mid-segment much less than half length of segment; tactile seta of tibia IV exceeded in length by at least one other seta on leg... 13
13. Femur IV more than twice as long as broad at base; tactile seta of tibia IV about two thirds as long as femur IV... *randsi*, p. 1133
Femur IV about one and one-half times as long as broad at base; tactile seta of tibia IV nearly as long as femur IV... *unguis*, p. 1210
14. Tactile seta of tibia IV much longer than femur IV... *texanus*, p. 1196
Tactile seta of tibia IV two thirds as long as femur IV... *waiti*, p. 1181

Tarsonemus occidentalis Ewing

(Plates 11, 18 and 23)

Tarsonemus occidentalis Ewing, 1939, U.S.D.A. Tech. Bull., 653, p. 21.

Male: Body elongate oval, broadest slightly anterior to forward condyles of coxae III, tapering gently anterior and abruptly posterior from this point. Apodemes conspicuous and well defined. Apodemes I as long as width of femur I, extending from inner angles of coxae I in posteromedial direction, converging medially about one third medial distance between inner angles of coxae I and II. Anterior median apodeme extending from point of juncture of apodemes I to main body suture. Apodemes II subparallel to apodemes I, about twice as long as the latter, extending from inner angles of coxae II and joining median apodeme at its posterior third. Transverse apodeme extending in anteromedial direction from anterior condyles of coxae III, terminating anteriorly two thirds the distance to main body suture. Apodemes IV subparallel to apodemes III, extending from outer basal condyles of coxae IV two thirds the distance to main body suture. Posterior median apodeme extending from point in line with bases of apodemes IV to point just behind anterior extremities of apodemes IV, this anterior extremity being trifurcate. Posterior interapodemal areas each bounded anteriorly by indistinct, convex apodemes forming scalloped anterior margin of total area. Propodosoma three fourths as long as broad at base, lateral margins deeply incurved slightly an-

terior to mid-lengths; narrow cephalothoracic shield projecting anterior to this point covering basal half of capitulum, the anterior margin of shield rounded truncate. Dorsum of hysterosoma divided transversally by a conspicuous suture at posterior fifth. *Dorsal chaetotaxy*: Propodosoma with first three pairs of setae arranged in a longitudinal row, setae of fourth pair between third pair and lateral margins of body; first pair of setae as long as combined lengths of femur and genu II, separated from each other by a distance slightly more than one half length of seta, located one half length of seta behind apex of cephalothoracic shield; second pair of setae nearly as long as first pair, located one half length of seta behind and slightly laterad from first pair, setae separated from each other by a distance equal to length of seta; third pair of setae nearly as long as width of body at main body suture, located the length of genu I in front of main body suture, the same distance from lateral margins of body at this point; fourth pair of dorsal propodosomal setae as long as first pair, located one fourth length of seta immediately laterad from setae of third pair. Hysterosoma with first pair of dorsal setae as long as coxa III, situated on lateral margins of body midway between anterior condyles of coxae III and main body suture; second pair of setae slightly shorter and stouter than first pair, located near lateral margins of body one half length of seta in front of posterior hysterosomal suture; third pair of setae slightly shorter than second pair, situated two thirds length of seta medial and slightly posterior to setae of second pair, this location being one third length of seta anterior to hysterosomal suture; fourth pair of dorsal hysterosomal setae one half as long as second pair, located between anterior third of genital papilla and lateral body margins. *Ventral chaetotaxy*: Propodosoma with first pair of setae as long as width of genu I, located the length of seta laterad from anterior extremity of median apodeme; second pair of setae slightly longer than first pair, situated twice length of seta laterad from median apodeme at point of juncture of apodemes II. Hysterosoma with first pair of setae slightly longer than tibia III, located just medial to anterior extremity of apodemes III; second pair of ventral hysterosomal setae slightly longer than first pair, situated just laterad from apodemes IV in line with anterior condyles of coxae III. *Capitulum*: Length including projecting palpi, 26μ ; width, 22μ ; subcordate with posterior margin rounded truncate. Dorsal setae two thirds as long as tibia I, separated from each other by a distance equal to width of tibia I at base; ventral setae nearly

as long as dorsal setae. Palpi and chelicerae projecting slightly beyond apex of capitulum, palpi indistinctly segmented; cheliceral sheaths without conspicuous strandlike thickenings. *Legs*: Anterior pairs elongate robust, similar in size and shape. Leg I with coxa subquadrangular, slightly broader than long, without setae; femur as long as distance between inner coxal condyles of legs I and II, about twice as long as broad, with three setae; genu two-thirds as long as femur, about one and one-fourth times as long as broad, with four normal setae; tibia slightly longer than genu, about twice as long as broad, with five normal setae and one clavate, annulated seta, the latter two thirds as long as basal width of segment and located near outer margin slightly proximad to mid-segment; tarsus as long as tibia, tapering slightly to broadly rounded apex, with one clavate, annulated seta nearly as long as basal width of segment, located dorsally near outer margin at basal fifth, one dorsal, peglike seta one third as long as annulated seta, located just medial to annulated seta, eight normal setae; tarsus surmounted by a short, narrow pretarsus bearing at its apex a broad empodium beyond which projects a single, stout, curved claw. Leg II with coxa subquadrangular, about as broad as long, without setae; femur about as long as femur I, one and one-half times as long as broad, tapering slightly to apex, with three setae; genu one half as long as femur, about as broad as long, with three setae; tibia slightly longer than genu, about one and one-third times as long as broad at base, tapering slightly from base to apex, with four setae; tarsus as long as tibia, two and one-half times as long as broad at base, tapering to broadly rounded apex, with four normal setae and two specialized setae, one of the latter clavate and annulate, its length almost equal to width of segment at base, located dorsally near outer margin at base, the other peglike, with length equal to half basal width of segment, located dorsally near outer margin at basal third; tarsus surmounted by a narrow pretarsus as long as the basal width of tarsus, bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Legs III with coxae widely separated, posterolateral angles projecting beyond body margins, length of coxa equal to combined lengths of genu and tibia II, nearly twice as long as greatest width, without setae; femur as long as combined lengths of genu and tibia II, outer margin concave medially, basal half of segment expanded bulbous, segment with one seta located on outer margin at apical third; genu slightly more than half as long as femur, one and one-half times as long as broad,

with three setae; tibia one and one-third times as long as genu, twice as long as broad, with four setae; tarsus slightly shorter than tibia, tapering from base to broadly rounded apex, with three setae; tarsus surmounted by a narrow pretarsus, as long as the width of tibia, bearing at its apex two strong, curved, spreading claws between which projects a broad empodium. Leg IV with coxa subquadrangular, broader than long, with one seta having length equal to two thirds width of segment, located ventrally at outer apical angle of segment; femur slightly longer than the distance between inner condyles of coxae II, length about twice greatest width of segment, width of femur at apex equal to half width at base, outer margin strongly convex, inner margin nearly straight and incurved at a pronounced angle near base, a prominent suture extending from inner margin the distal width of segment before apex to outer apical angle, segment with one dorsal seta having a length nearly equal to length of segment situated near outer margin at its mid-length, one ventral seta one half as long as segment located near inner margin just proximad to juncture of diagonal suture with inner lateral margin of segment, one seta with length slightly less than apical width of segment located ventrally on inner margin slightly proximad to mid-segment; tibia one and one-third times as long as broad at base, outer margin slightly convex, inner margin with a short, shallow, concave notch in a medial position on the margin, segment with one lanceolate seta as long as apical width of segment located dorsally near outer margin just before apex, one strong seta about two and one-half times as long as segment located ventrally near outer margin just before apex; tarsus short, nearly twice as broad as long, with one seta as long as width of segment located dorsally on inner margin just before apex, one seta as long as width of segment located ventrally on inner margin at apex, one short seta as long as segment situated middorsally at apex; tarsus surmounted by a broad, curved, pointed claw two thirds as long as tibia. *Genital papilla*: Length, 29μ ; width, 25μ ; subcordate, anterior margin emarginate, a conspicuous suture transecting papilla at its apical third. *Anal plate*: Conspicuous and well defined; anal orifice oval in shape, largest diameter equal to basal width of tarsus III, with three radiating apodemes, the median apodeme as long as basal width of tarsus III, extending from caudal margin of center ring one half the distance to anterior margin of genital papilla, anterior apodemes as long as genu III, spreading a distance equal to two thirds width of genital papilla. *Measurements*: Length from tip of capitulum to apex of genital papilla, 158μ ; main body suture to apex of genital

papilla, 96 μ ; anterior margin of cephalothoracic shield to main body suture, 49 μ ; width of body at main body suture, 69 μ ; width immediately in front of anterior apodemes of coxae III, 81 μ .

Female: Body broadly oval, broadest at mid-length. Apodemes distinct and well defined. Apodemes I as long as genu I, extending from inner angles of coxae I in posteromedial direction, converging at mid-body at point opposite mid-distance between inner angles of coxae I and II. Apodemes II subparallel to apodemes I, extending from inner angles of coxae II, converging medially midway between anterior extremity of median apodeme and main body suture, basal third of apodemes indistinct, recurved. Anterior median apodeme clearly defined from anterior extremity at intersection with apodemes II to point of juncture with curved medial extremities of apodemes II, less distinct posterior from this point to its indistinct terminus midway between hind extremities of apodemes II and main body suture. Transverse apodeme conspicuous and well-defined, transecting body ventrally, apodeme discontinuous in medial zone for a distance nearly equal to the length of apodeme II. Apodemes III one third as long as coxa III, extending in an anteromedial direction from anterior condyles of coxae III. Apodemes IV slightly longer than coxae III, extending in an anteromedial direction from points slightly mesad and anterior to inner apical angles of coxae III, apodemes with a slight indentation at about mid-length, terminating just before juncture with median apodeme at point nearly in line with anterior extremities of coxae III. Posterior median apodeme extending mid-ventrally from a point in line with hind extremities of coxae III to a point nearly in line with basal extremities of coxae III, apodeme bifurcate at this point with each arm extending for a short distance in anterolateral direction; each fork at anterior extremity of apodeme having a length equal to the distance from base of fork to point nearest anterior extremities of apodemes IV. Hysterosoma transected dorsally by five sutures, the first at about anterior third of coxa III; second suture at posterior extremities of coxae III; third suture about one fourth distance from coxae IV to apex of body; fourth suture two thirds distance from third suture to apex of body; fifth suture midway between fourth suture and apex of body. Cephalothoracic shield not prolonged, anterior margin truncate and barely extending over base of capitulum. Pseudostigmatic organs short; length including pedicel equal to length of genu I, expanded apex oval, about twice as long as the narrow pedicel;

basal plates associated with areolus consisting of two heavily sclerotized, rectangular sclerites as long as the greatest width of organ at its apex. Stigmatal openings and tracheae obscure. *Dorsal chaetotaxy*: Propodosoma with first pair of setae as long as width of capitulum, located one third length of seta behind anterolateral angles of cephalothoracic shield, separated from each other by a distance equal to three fourths length of seta; second pair of setae with length equal to one half width of body at main body suture, one half length of seta from lateral margins of body. Hysterosoma with first pair of setae nearly as long as femur I, located near lateral margins of body one half length of seta behind main body suture; second pair of setae slightly longer than first pair, located one and one-half times length of seta from lateral margins of body, one half length of seta anterior to first hysterosomal suture, this position being slightly behind anterior condyles of coxae III; third pair of dorsal hysterosomal setae as long as but stouter than setae of second pair, located one and one-third times length of seta from lateral body margins, one fourth length of seta anterior to third hysterosomal suture, separated from each other by a distance equal to two and one-half times length of seta; fourth pair of setae slightly shorter than third pair, located on lateral margins of body just anterior to fourth hysterosomal suture; fifth pair of setae slightly longer than third pair, situated on anterior margin of penultimate segment, separated by a distance equal to length of seta; sixth pair of setae slightly shorter than fifth pair, located near base of apical segment of hysterosoma on lateral margins of body, setae separated from each other by a distance equal to twice length of seta. *Ventral chaetotaxy*: Propodosoma with first pair of setae as long as width of genu I, located slightly behind apodemes I at their mid-lengths; second pair as long as genu II, located on posterior margins of apodemes II at their anterior thirds. Hysterosoma with first pair of setae as long as tarsus II, located slightly more than the length of seta behind main body suture, one half length of seta laterad from forward extremities of anterior forks of median apodeme; second pair of setae as long as first pair, located on lateral margins of apodemes IV just before their posterior extremities; third pair of ventral hysterosomal setae as long as the greatest width of coxa III, located at apex of opisthosoma, separated from each other by a distance equal to one and one-half times length of seta. *Capitulum*: Length including projecting palpi, 34 μ ; width, 28 μ ; subcordate with posterior margin slightly emarginate. Median dorsal apodeme extending entire length of capsule, unbranched. Dorsal setae as

long as genu II, located near apex of capitulum, separated from each other by a distance equal to length of seta; ventral setae as long as dorsal setae. Palpi robust, two-segmented, projecting a short distance beyond apex of capitulum. Chelicerae projecting slightly beyond apex of capitulum; cheliceral sheaths with conspicuous spiral thickenings. *Legs*: Anterior pairs elongate, robust. Leg I with coxa subquadrangular, one and one-third times as broad as long, without setae; femur two thirds as long as greatest width of capitulum, twice as long as broad, inner margin incurved at basal third, segment with three setae; genu two thirds as long as femur, one and one-half times as long as broad, lateral margins subparallel, with three setae; tibiotarsus as long as femur, about three and one-half times as long as broad at base, tapering from base to broadly rounded apex, with one short, clavate, annulated seta having a length equal to one half basal width of segment located dorsally on outer margin the length of seta from base, one long, clavate, annulated seta as long as the basal width of segment located dorsally near outer margin at mid-segment, ten normal setae; tibiotarsus surmounted by a short pretarsus with length equal to one third basal width of tarsus, bearing at its apex a broad empodium beyond which projects a single, strong, curved claw. Leg II with coxa subquadrangular, one and one-third times as broad as long, without setae; femur short, nearly as broad as long, one and one-half times as broad as femur I, having length about equal to length of femur I, with three setae; genu less than one half as long as femur, width at base equal to length, lateral margins converging slightly, with one stout, lanceolate seta as long as segment located dorsally near outer margin at base, two normal setae; tibia slightly longer than genu, one and one-half times as long as broad at base, lateral margins somewhat convex, segment with three setae; tarsus narrow, rugose, about twice as long as broad at base, tapering from base to apex, length equal to length of tibia, with one annulated, clavate seta with length equal to two thirds basal width of segment located dorsally near outer margin one half length of seta from base of segment, one short, stout spine with length equal to one half basal width of segment, the diameter of spine at base nearly equal to its length, located on outer margin at base of segment, three normal setae; tarsus surmounted by a short pretarsus with length equal to one half basal width of tarsus, and bearing at its apex two strong, spreading, curved claws between which projects a broad empodium. Leg III with coxa narrow, elongate, length nearly equal to twice length of tibia, broadest at anterior fourth, its greatest breadth

about one fourth length of segment, without vestiture; femur slightly more than one half as long as coxa, constricted at basal third, proximal third of segment bulbous, distal two thirds of segment with lateral margins divergent to apex, width at apex equal to one third length of segment, segment with three setae; tibia as long as femur, about three times as long as broad at base, tapering slightly to apex, with four normal setae; tarsus narrow, elongate, two thirds as long as tibia, nearly five times as long as broad at base, with three setae; tarsus surmounted by a narrow, elongate pretarsus nearly one half as long as tarsus, bearing at its apex two strong, curved, spreading claws and a broad empodium. Leg IV with coxa subquadrangular, slightly longer than broad, length equal to apical width of femur III, without setae; trochanter small, collarlike, broader than long, without vestiture; third segment narrow, elongate, length equal to transverse distance between anterior coxal condyle of leg III and posterior median apodeme, one ventral seta nearly one-half as long as segment situated near outer margin one half basal width of segment from base, one stout seta one half as long as segment located ventrally near outer margin the basal width of segment before apex; fourth segment nearly one half as long as third segment, lateral margins subparallel, with one stout, mid-ventral seta as long as third segment situated the width of fourth segment before apex, one terminal seta longer than leg IV. *Measurements:* Apex of capitulum to tip of opisthosoma, 212 μ ; anterior margin of cephalothoracic shield to main body suture, 66 μ ; main body suture to tip of opisthosoma, 121 μ ; width of body at main body suture, 103 μ ; width at anterior coxal condyles of legs III, 119 μ ; distance between anterior coxal condyles of legs III, 56 μ .

Types: Summer, Washington, Mar. 22, 1934, F. F. Smith, on *Fragaria* sp. One slide mounting five females and two males; one of the males ringed by the present author and herewith designated lectotype.

Location of types: United States National Museum No. 1121.

Material examined by this writer in addition to the type series included slides with the following data: Males and females, De Faures, Ohop Creek, Eatonville, Wash., Nov. 12, 1934, Wm. W. Baker, *Eriophyes* gall on *Salix* sp.; De Faures, South Prairie, Wash., Oct. 26, 1934, Wm. W. Baker, evergreen blackberry; De Faures, Skamokawa, Wash., Oct. 16, 1934, Wm. W. Baker, evergreen blackberry; De Faures, South Bend, Wash., Oct. 17, 1934, Wm. W. Baker, evergreen blackberry; Quinault, Wash., Oct. 20, 1933, Wm. W. Baker, apple; De Faures, Puyallup, Wash., Nov. 26, 1934, Wm. W.

Baker, *Spiraea douglasii*; Osceola, Wash., Sept. 13, 1933, Wm. W. Baker, evergreen blackberry; De Faures, Puyallup, Wash., Aug. 18, 1934, evergreen blackberry; Puyallup, Wash., Aug. 8, 1934, Wm. W. Baker; Puyallup, Wash., Sept. 30, 1933, Wm. W. Baker, strawberry; Puyallup, Wash., July 25, 1933, Wm. W. Baker, native dewberry; De Faures, Puyallup, Wash., Oct. 9, 1934, Wm. W. Baker, *Corylus californica*.

The female of this species very closely resembles *T. smithi*, the most conspicuous distinguishing characters being the continuation of apodemes II posteriorly to a juncture with the anterior median apodeme and the interruption of the transverse apodeme mesally; also the bifurcate anterior extremity of the posterior median apodeme. It may be distinguished from *T. setifer* in male characters by the short tactile seta of tibia IV and in females by the absence of the dorsal propodosomal apodeme.

Tarsonemus setifer Ewing

(Plates 9, 18 and 23)

Tarsonemus setifer Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 19.

Tarsonemus bakeri Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 20; McGregor, 1942, California Citrograph, vol. 27, no. 10, p. 270; McGregor, 1944, California Citrograph, vol. 30, no. 2, p. 53. (new synonymy.)

Male: Body broad, oval, broadest at anterior coxal condyles of legs III, tapering abruptly to apex of opisthosoma and gently to apex of propodosoma. Apodemes conspicuous and well defined. Apodemes I as long as width of genu I, converging medially at point in line with posterior angles of coxae I, terminating anteriorly at inner condyles of coxae I. Apodemes II about twice as long as apodemes I, extending from inner condyles of coxae II in postero-medial direction, terminating just before juncture with median apodeme. Anterior median apodeme well defined from its anterior extremity at juncture of apodemes I to a point almost in line with medial extremities of apodemes II, narrowed and less distinct beyond this point to its posterior extremity just before main body suture. Posterior apodemes nearly parallel for most of their lengths, converging slightly anteriorly. Apodemes III extending from anterior condyles of coxae III in anteromedial direction for slightly more than one half the distance to main body suture. Apodemes IV extending from outer basal angles of coxae IV in a direction nearly parallel to apodemes III, terminating anteriorly midway between anterior extremities of apodemes III and median apodeme. Posterior median apodeme with its anterior extremity nearly in line with anterior extremities of apodemes III and IV, extending

caudad from this point for two thirds the distance to inner basal angles of coxae III where apodeme divides, each fork continuing to inner, basal, coxal angles of legs IV. Posterior apodemes connected anteriorly by rather inconspicuous, transverse apodemes which present a scalloped anterior margin to the interapodemal area, each interapodemal area broadest posteriorly with anterior limit rounded truncate. Cephalothoracic shield absent. *Dorsal chaetotaxy*: Propodosoma with first three pairs of setae arranged in a longitudinal row, setae of fourth pair located almost directly laterad from setae of third pair; first pair of setae nearly as long as capitulum, located in line with inner angles of coxae I and separated from each other by a distance equal to half length of seta; second pair of setae three fourths as long as first pair, located two thirds length of seta behind and slightly laterad from first pair, about in line with posterior angles of coxae I; third pair of setae as long as width of body at main body suture, located the width of tibia II behind and slightly laterad from setae of second pair; fourth pair of dorsal propodosomal setae as long as first pair, located the basal width of tarsus II laterad from and slightly behind setae of third pair. Hysterosoma with first pair of setae as long as combined lengths of genu and tibia III, located near lateral margins of body midway between anterior condyles of coxae III and main body suture; second pair of setae slightly longer and stouter than first pair, located near lateral margins of body one third length of seta behind anterior extremities of coxae III; third pair of setae three fourths as long as second pair, situated two thirds length of seta from lateral margins of body nearly in line with anterolateral angles of coxae IV; fourth pair of setae about one half as long as third pair, located beside lateral margins of genital papilla at its anterior fourth. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae, first pair minute, length equal to basal width of tarsus I, located the length of seta directly laterad from anterior extremity of median apodeme; second pair as long as genu I, situated about two thirds length of seta behind mid-lengths of apodemes II. Hysterosoma with first pair of setae two thirds as long as tibia III, situated medially in interapodemal area defined by apodemes III and IV just behind anterior limit of area; second pair of setae subequal in length to first pair, located in same interapodemal area close to apodemes IV, in line with anterior extremities of coxae III. *Capitulum*: Length including projecting palpi, 33μ ; width, 28μ ; subcordate with posterior margin rounded truncate. Apodemes not clearly defined. Dorsal and ventral setae

about the same distance behind apex of capitulum, the latter slightly longer than the former. Palpi and chelicerae extending beyond apex of capitulum, bases of cheliceral sheaths with faint transverse striations. *Legs:* Anterior pairs subequal in size and shape, legs I slightly longer than legs II. Leg I with coxa subquadrangular, one and one-third times as broad at base as long, tapering from base to apex, without setae; femur short, one and one-fourth times as long as greatest breadth, outer margin twice as long as inner margin and incurved at basal third, with three normal setae; genu two thirds as long as femur, as broad as long, lateral margins subparallel, segment with four setae; tibia one and one-fourth times as long as genu, twice as long as broad, lateral margins subparallel, with five normal setae and one short, clavate seta with length equal to one third width of segment, located dorsally near outer margin at mid-segment; tarsus as long as tibia, about three times as long as broad at base, tapering from base to apex with seven normal, one bristlelike and one clavate setae, the latter annulated and three fourths as long as basal width of segment, situated middorsally the length of seta from base of segment, the bristlelike seta two thirds as long as the clavate seta and located dorsally near outer margin at about mid-segment; tarsus surmounted by a strong, curved claw the apex of which projects beyond a broad, subcircular empodium. Leg II with coxa subquadrangular, one and one-half times as broad as long, without setae; femur short, slightly longer than greatest breadth, inner margin less than one half as long as outer margin, with three setae; genu two thirds as long as femur, as broad as long, with three setae; tibia one and one-third times as long as genu, nearly twice as long as broad, with four setae; tarsus as long as tibia, about three times as long as broad at base, tapering abruptly from base to narrowly rounded apex, with one short, broad, annulated seta twice as long as broad, its length equal to two thirds basal width of segment, located dorsally near inner margin one half length of seta from base of segment, three normal setae; tarsus terminated by a short, narrow pretarsus bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa subtriangular, nearly twice as long as broad, length equal to combined lengths of genu and tibia III, anterior extremity a distance equal to combined lengths of last four segments of leg III behind main body suture, segment without vestiture; femur two thirds as long as coxa, about twice as long as broad, basal third of segment subglobose, with one dorsal seta one half as long as segment located

on outer margin at apical third of segment; genu slightly more than one half length of femur, slightly longer than broad, lateral margins subparallel, with three setae; tibia one and one-third times as long as genu, twice as long as broad, segment with four normal setae; tarsus about as long as tibia, tapering from base to apex, with two setae; tarsus surmounted by a narrow pretarsus, one third as long as tarsal segment, bearing apically two strong, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa subquadrangular, about one and one-half times as broad as long, with one ventral seta as long as segment located one third length of seta from outer margin at apical third of segment; femur long, robust, about two and one-half times as long as greatest breadth, broadest at basal third, width at apex about one half width at basal third, outer margin convex, inner margin straight for most of its length, curved inward at basal fourth, segment with one weak dorsal seta nearly as long as greatest width of segment and located near outer margin two thirds length of seta before apex of segment, one ventral seta with length equal to apical width of segment located on inner margin just proximad to mid-segment, one strong dorsal seta one half as long as segment located near inner margin a distance equal to apical width of segment before apex; tibia about twice as long as broad at base, outer margin straight, inner margin concave, with one long tactile seta, longer than leg IV, situated midventrally at apical fifth of segment, one peglike seta nearly as long as apical width of segment located dorsally near outer margin one half length of seta before apex; tarsus short, about twice as broad as long, with one spinelike seta as long as basal width of claw located dorsally near outer margin at apex of segment, one seta two thirds as long as tibia located dorsally near inner margin at apex, one seta two thirds as long as tibia located ventrally near inner margin at apex of segment; tarsus bearing at its apex a strong, gently curved claw two thirds as long as tibia. *Genital papilla*: Length, 30 μ ; width, 29 μ ; subcordate, anterior margin rounded truncate with narrow cleft medially; posterior half of papilla projecting beyond tip of opisthosoma. *Anal plate*: Situated a distance equal to one third width of genital papilla in front of anterior margin of the latter; circular medial orifice with a diameter equal to two thirds basal width of tarsus III, radiating apodemes of equal length and as long as basal width of tibia III. *Measurements*: Length from tip of capitulum to apex of genital papilla, 175 μ ; main body suture to apex of genital papilla, 103 μ ; width at main body suture, 76 μ ; width of body at coxae III, 90 μ .

Female: Body broadly oval, broadest at mid-length. Anterior apodemes distinct, those of legs I extending from inner angles of coxae I in posteromedial direction converging medially at a point midway between inner angles of coxae I and II. Apodemes II extending from inner angles coxae II in a direction subparallel to apodemes I, joining median apodeme at a point about in line with hind margins of coxae II; apodemes well defined at anterior two thirds, less distinct at posteromedial third. Anterior median apodeme extending from anterior extremity at Y-juncture of apodemes I to main body suture, indistinct at region of juncture of apodemes, and at posterior extremity from main body suture half the distance to juncture of apodemes II. Transverse apodeme clear and well-defined, extending nearly the width of body, its length broken for a short distance at two points the basal width of tarsus II laterad from mid-line. A small dorsal apodeme located medially on propodosoma the basal width of tarsus II anterior to main body suture, apodeme extending medially anterior from this point for distance equal to its distance from main body suture, two laterally directed curved forks extending from its posterior extremity, each slightly longer than median portion of apodeme. Posterior apodemes inconspicuous, those of legs III less than one half as long as coxae III, extending in anteromedial direction from forward extremities of coxae III; apodemes IV appearing as thin lines about as long as apodemes I, posterior extremities situated two thirds the length of apodemes mesad from inner margins of coxae III at their basal thirds extending in anteromedial directions from these points, their anterior extremities about in line with anterior thirds of coxae III and separated from each other by a distance nearly equal to twice length of apodeme. Posterior median apodeme absent. Hysterosoma divided dorsally by six indistinct transverse sutures. Cephalothoracic shield rounded truncate, covering basal third of capitulum. Pseudostigmatic organs with expanded apices subcircular, nearly as broad as long; pedicels narrow, elongate, as long as expanded apices; basal plates with two semicircular, heavily sclerotized areas nearly as long as greatest width of apex of organ, situated immediately above inner angles of coxae II. Stigmatal openings located on pronounced dorsolateral expansions situated just behind anterior extremity of cephalothoracic shield; tracheae indistinct. *Dorsal chaetotaxy:* Propodosoma with first pair of setae nearly as long as greatest width of capitulum, located one third length of seta behind anterolateral margins of cephalothoracic shield, this distance mesad to lateral margins of body; second pair of setae slightly longer than

width of body at main body suture, located the basal width of tarsus II behind basal ring of pseudostigmatic organs, this being about one fourth the distance from basal plates of organs to transverse apodeme. Hysterosoma with first pair of setae two-thirds as long as coxa III, located one third length of seta from lateral margins of body, about midway between main body suture and anterior extremities of coxae III; setae of second pair one third as long as first pair, located immediately above and slightly mesad to anterior condyles of coxae III; third pair of setae stout, slightly longer than second pair, located one third length of seta behind coxae IV and separated from each other by a distance equal to three times length of seta; fourth pair of setae nearly as long as third pair, located two thirds length of seta from lateral margins of body, about midway between coxae IV and tip of opisthosoma; fifth pair of setae as long as tarsus III, located in line with fourth pair of setae, separated from each other by a distance one and one-half times length of seta and separated from setae of fourth pair by an equal distance; sixth pair of setae two thirds as long as fifth pair, situated on body margins the length of seta before apex, setae separated from each other by a distance equal to four times length of seta. *Ventral chaetotaxy*: Two pairs of ventral setae on propodosoma; first pair minute, length equal to two thirds basal width of tarsus II, located on apodemes I at their mid-lengths; second pair as long as genu II, located just behind mid-points of apodemes II. Hysterosoma with first pair of setae one and one-half times as long as apical segment of leg IV, located one third length of seta medial to anterior extremities of apodemes III; second pair of setae as long as first pair, located at hind extremities of apodemes IV; third pair of seta slightly shorter than second pair, located at apex of opisthosoma, setae separated from each other by a distance equal to one and one-half times length of seta. *Capitulum*: Length including projecting palpi, 41μ ; greatest width, 35μ ; caudal margin very slightly concave. Dorsal setae as long as width of genu I, separated from each other by a distance equal to one and one-fourth times length of seta, situated in line with ventral setae, the latter as long as dorsal setae. Palpi short, broad, two-segmented; chelicerae projecting slightly beyond apex of capitulum, cheliceral sheaths not striate. Dorsal, longitudinal, median apodeme nearly as long as capitulum, lateral branches broad, well-defined, extending from mid-lateral margins to posterior extremity of medial apodeme. *Legs*: Anterior pairs elongate, robust. Leg I with coxa subquadrangular, one and one-half times

as broad as long, without setae; femur short, about one and one-third times as long as greatest breadth, inner margin one half as long as outer margin, segment with three setae; genu one and one-third times as long as broad, tapering slightly from base to apex, with four normal setae; tibiotarsus broad, elongate, one and one-half times as long as genu, three times as long as broad at base, tapering slightly to broadly rounded apex, with one peglike seta having length equal to basal width of segment, situated dorsally near outer margin at basal fifth of segment, one small, clavate, annulated seta with length equal to one half basal width of segment, situated mid-dorsally at basal fourth, one clavate, annulated seta as long as basal width of segment, located middorsally slightly distad to mid-segment, ten normal setae; tarsus surmounted by a short, narrow pretarsus bearing at its apex a long, curved claw which projects beyond a broad empodium. Leg II with coxa subquadrangular, about one and one-half times as broad as long, without setae; femur short, slightly longer than broad, with two setae, first seta lanceolate, its length equal to one half apical width of segment, located dorsally at mid-point on inner margin, second seta as long as greatest width of segment located dorsally near outer margin at mid-segment; genu broader than long, with two normal setae and one strong, lanceolate seta, the latter slightly longer than segment and located dorsally near inner margin at base; tibia one and one-fourth times as long as broad, about as long as genu, with four setae; tarsus one and one-fourth times as long as tibia, tapering abruptly to its narrowly rounded apex, with one clavate, annulated seta having a length nearly equal to basal width of segment, located dorsally near inner margin at base, one stout, lanceolate seta one third as long as segment located ventrally near inner margin at mid-segment, one short, broad, lanceolate seta with length equal to one third basal width of segment located ventrally near inner margin the length of seta before apex, two normal setae; tarsus surmounted by a narrow pretarsus, nearly as long as basal width of tarsus, bearing at its apex two strong, spreading, curved claws between which projects a broad empodium. Leg III with coxa broad, elongate, about three and one-half times as long as greatest breadth, inner and outer margins convex, segment as long as combined lengths of genu and tibiotarsus I, without vestiture; femur slightly more than one half as long as coxa, bulbous at basal third, slightly expanded apically, with three normal setae; tibia as long as femur, about three times as long as broad, tapering slightly from base to apex, with four

setae; tarsus narrow, elongate, three fourths as long as tibia, lateral margins subparallel, segment with three setae; tarsus surmounted by a narrow pretarsus one half as long as tarsal segment, supporting at its apex two strong, spreading, curved claws between which projects a broad empodium. Leg IV with coxa subquadrangular, slightly longer than broad, lateral margins convex, without setae; trochanter collarlike, broader than long, without setae; third segment narrow, elongate, length equal to one half distance between anterior coxal condyles of legs III, with one seta one fifth as long as segment located ventrally near outer margin about two thirds length of seta from base, one ventral seta as long as segment located near outer margin the apical width of segment before apex; fourth segment slightly more than one fourth as long as third segment, with one stout, ventral seta about three times as long as segment located near outer margin the width of segment before apex, one apical seta about twice as long as leg IV. *Measurements*: Apex of cephalothoracic shield to tip of opisthosoma, 204 μ ; tip of shield to main body suture, 61 μ ; width of body at main body suture, 99 μ ; width at anterior coxal condyles of legs III, 134 μ ; distance between anterior coxal condyles of legs III, 63 μ .

Types: Nest View (Pittsburgh), Pa., Nov. 2, 1933, F. F. Smith, on chrysanthemum. One of the male specimens has been encircled by the present author and is here designated lectotype.

Location of types: United States National Museum No. 1119; slide with two males, several females.

Material examined by this writer in addition to the type series included specimens with the following data: Santa Paula, Calif., Oct. 1945, C. J. Barrett, orange buttons; De Faures, Oak Point, Wash., Oct. 18, 1934, Wm. W. Baker, *Rubus leucodermis*; San Jose, Calif., Dec. 20, 1934, raspberry buds; Puyallup, Wash., Sept. 8, 1933, Wm. W. Baker, evergreen blackberry; Puyallup, Wash., Oct. 4, 1933, Wm. W. Baker, evergreen blackberry; Himalaya, Tacoma, Wash., Sept. 22, 1931, Wm. W. Baker; Sumner, Wash., Sept. 16, 1931, S. E. Crumb, in blackberry; Santa Paula, Calif., 1939, lemon; Riverside, Calif., Mar. 19, 1938, K. Maxwell, on pomegranate leaf and bud scales; Whittier Lab., Calif., Apr. 1, 1943, Munger, on old lemon from lath house; Corona, Calif., Mar. 9, 1942, E. A. McGregor, on lemon; Santa Paula, Calif., June 30, 1937, A. M. Boyce, in lemon buds; Selma, Calif., Feb. 24, 1940, S. F. Bailey, on peach; La Habra, Calif., Sept. 18, 1937, E. A. McGregor, in lemon buds; U. C. campus, Berkeley, Calif., Oct. 11, 1949, R. E. Beer, verbena; San

Francisco, Calif., Oct. 12, 1949, S. E. Hall, monterey pine infested with phytotipalpids; Roger Reynolds' Nursery, Atherton, San Mateo Co., Calif., Nov. 1, 1949, R. E. Beer, bamboo infested with *Antonina* sp.; U. C. greenhouse, Berkeley, Calif., Oct. 20, 1949, R. E. Beer, *Tradescantia* sp.; John Edwards' Nursery, Palo Alto, Calif., Nov. 1, 1949, R. E. Beer, dead leaves of daphne; Plath's Nursery, San Francisco, Calif., Sept. 29, 1949, R. E. Beer, quack grass.

In general appearance living mites are opaque white or amber colored. Indications are that it is a very common species, and in areas collected by this author *T. setifer* was encountered more frequently than any other species of tarsonemid mite. Specimens have been reared through several generations in agar slant cultures of fungus. Because of their rather large size in comparison to other species, their relative abundance and ease of obtaining specimens, together with the comparative ease of rearing the mites, this species lends itself well to biological studies. In one experiment conducted by this writer males of this species were observed portaging male "pupae" of *T. pritchardi*.

T. bakeri is obviously a synonym of *T. setifer*; the figures for the two species in the publication containing original descriptions of each present no dissimilarities of note, and the type specimens of *T. bakeri* agree in every detail with those of *T. setifer*.

Although males and females of *T. setifer* very closely resemble *T. occidentalis*, the short tactile seta of femur IV in the male *T. occidentalis* and the presence of a small dorsal propodosomal apodeme in the female *T. setifer* quickly separates both sexes of these species. The male of *T. setifer*, in addition to the characters indicated in the key, further differs from *T. smithi* in the location of the first pair of ventral hysterosomal setae, which appear on the anterior margins of the interapodemal areas defined by apodemes III and IV rather than well behind these margins as occurs in *T. smithi*.

Tarsonemus randsi Ewing

(Plates 11, 18 and 23)

Tarsonemus randsi Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 25.

Tarsonemus iowensis Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 48.
(new synonymy.)

Male: Body moderately elongate, oval, broadest at posterior two fifths in line with anterior extremities of coxae III; apodemes strong and well defined; genital papilla large, larger than capitulum; anal plate rather small but distinct. Apodemes I nearly as long as genu I, extending in posteromedial directions from innermost

angles of coxae I, converging medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II strong, slightly more than twice as long as apodemes I and subparallel to the latter, their mesal extremities not quite contacting median apodeme and located a short distance anterior to transverse apodeme. Transverse apodeme not as strong as other apodemes of the propodosoma but distinct for its entire length, less distinct medially than laterally, transecting body just in front of main body suture. Anterior median apodeme distinct for most of its length, interrupted for a short distance only just anterior to posterior extremities of apodemes II, extending from transverse apodeme to point of convergence of apodemes I. Apodemes III extending in anteromedial directions from anterior condyles of coxae III, curving smoothly inward at anterior thirds to join apodemes IV. Apodemes IV extending anteromedially in a nearly straight line from outer basal condyles of coxae IV to point of juncture with apodemes III, looping forward and mesally from this point to converge at anterior extremity of median apodeme. Posterior median apodeme strong and distinct for its entire length, extending from point of convergence of apodemes IV, which is the width of capitulum behind main body suture, to a point in transverse line with outer basal extremities of coxae IV, the apodeme bifurcate at this point the arms remaining approximate to each other as they continue to inner basal angles of coxae IV. Dorsum of propodosoma projected forward somewhat to form a cephalothoracic hood which covers base of capitulum, the anterior margin of hood angularly truncate and as broad as the capitulum. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae about as long as combined lengths of genu, tibia and tarsus I, situated one fourth length of seta behind anterior margin of propodosoma and separated from each other by a distance equal to one third length of seta; second pair of setae about three fifths as long as setae of first pair, situated behind and slightly laterad from first setae a distance equal to two thirds length of second seta; third pair of setae one and two-thirds times as long as first setae, located behind and slightly laterad from second setae a distance about equal to distance separating first and second setae; fourth pair of setae about as long as second setae, located laterad from and slightly behind setae of third pair a distance equal to one third length of fourth seta. First pair of dorsal hysterosomal setae about two thirds as long as third propodosomals, located near lateral margins of body the length of seta from main body suture; second pair of setae about one half as long as first pair; third pair

of setae two thirds as long as first pair; fourth pair of dorsal hysterosomal setae about three fourths as long as setae of third pair, situated near lateral margins of genital papilla at anterior fourth of papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as basal width of tarsus I, located the length of seta laterad from juncture of apodemes I; second pair of setae slightly longer than setae of first pair, situated near centers of areas delimited by apodemes II, median apodeme, transverse apodeme and bases of coxae II. First pair of ventral hysterosomal setae nearly as long as second dorsal propodosomals, located in anterior eighth of area delimited by apodemes III and IV; second ventral hysterosomals slightly shorter than setae of first pair, situated on apodemes IV at their posterior two fifths. *Capitulum*: Subcordate with posterior rounded and with a shallow emargination medially; length including projecting palpi, 28μ ; greatest width, measured at posterior third, 21μ . Dorsal setae with length slightly less than greatest width of capitulum, located near anterolateral margins of capsule. Ventral setae slightly shorter than dorsal setae, located near bases of palpi and separated from each other by a distance equal to two thirds length of seta. Palpi of moderate length and thickness, projecting beyond apex of capitulum for a short distance, inconspicuously segmented and ornamented. Styliform chelicerae project between but not beyond palpi; cheliceral sheaths minutely striate. *Legs*: Anterior pairs moderately long and stout, subequal in length but legs I slightly more robust than legs II; posterior pairs moderately long and stout. Leg I with coxa subquadrangular, broader than long, without vestiture; femur as long as coxa, tapering from base toward apex, with three normal setae; genu about as broad as long, with four setae; tibia slightly longer than genu and slightly longer than broad, with one rodlike seta with length equal to two thirds basal width of segment, situated dorsally near outer margin one-half length of seta from base of segment, one clavate, annulated seta with length equal to one half basal width of segment, situated middorsally the length of seta from base of segment, one capitate sense seta as long as the rodlike seta, located between this latter seta and the clavate seta, five normal setae; tarsus slightly longer than tibia, tapered from base to narrowly rounded apex, with one broad, clavate, annulated seta having length equal to basal width of segment, situated dorsally near outer basal margin of segment, eight normal setae; tarsus surmounted by a short pretarsus bearing at its apex a strong, curved claw and a broad empodium. Leg II with coxa of the same shape as coxa I but slightly larger, without

vestiture; femur slightly longer but not as broad as femur I, with three setae; tibia slightly longer than genu, with four setae; tarsus about twice as long as tibia, tapering slightly from basal third to broadly rounded apex, with one large, clavate, annulated seta having length greater than basal width of segment, situated dorsally near inner basal margin of segment, one stout, spinelike, sensory seta with length equal to one half basal width of segment, located dorsally near outer basal margin of segment, four normal setae; tarsus surmounted by a short, broad pretarsus bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa slender, elongate, as long as combined lengths of genu, tibia and tarsus I, about one third as broad as long, without vestiture; femur two thirds as long as coxa, basifemur separated from telofemur by an incomplete suture at middle of segment, one seta on telofemur; genu one half as long as broad, with three setae; tibia slightly shorter than and equally as broad as genu, with four setae; tarsus slender, elongate, one and one-half times as long as genu, tapering from base to apex, with three setae; tarsus surmounted by a short, broad pretarsus bearing at its apex two long, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa large, subquadrangular, nearly one and two-thirds times as broad as long, with one seta; femur stout, elongate, about twice as long as broad at base, tapering from base toward apex with width at apex about one third width at base, one dorsal seta three fourths as long as segment located near outer margin slightly distad from mid-segment, one ventral seta nearly two thirds as long as dorsal seta, situated near inner margin at apical fourth of segment, one small ventral seta, shorter than apical width of segment, located on inner margin at basal third; tibia robust, only slightly longer than broad at base, with one rodlike, sensory seta one half as long as segment, located dorsally near outer apical margin, one short tactile seta twice as long as segment, located ventrally near outer apical margin; tarsus small, broader than long, with two short dorsal setae and one short ventral seta; tarsus surmounted by a large, curved claw as long as tibia. *Genital papilla*: Subcordate with anterior margin slightly emarginate; length excluding extended styliiform aedeagus, 31 μ ; greatest width, measured at mid-length of papilla, 26 μ . *Anal plate*: Small but conspicuous, situated the length of tibia IV in front of anterior margin of genital papilla, two strong, short apodemes projecting anterolaterally from anterolateral extremities of central disc. *Measure-*

ments: Length from tips of palpi to apex of genital papilla, 191 μ ; main body suture to apex of genital papilla, 113 μ ; anterior margin of cephalothoracic hood to main body suture, 50 μ ; width of body at anterior condyles of coxae III, 97 μ .

Female: Body broadly oval, broadest at mid-length. Legs of moderate length and robustness; legs II only slightly larger than legs I; legs III and IV of moderate size, the latter not extending to margins of body; legs III separated from each other at nearest point by a distance slightly less than length of coxa III; inner angles of coxae IV separated from each other by a distance equal to length of coxa IV. Apodemes moderately distinct, those of legs I extending in posteromedial directions from innermost angles of coxae I and converging medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II subparallel to apodemes I, extending from innermost angles of coxae II for a distance equal to the length of femur I, terminating abruptly at points the basal width of tarsus II from median apodeme. Transverse apodeme thickened and distinct, extending in a posteriorly directed arc from points the basal width of tibia II behind posterolateral extremities of coxae II to an indistinct juncture with median apodeme and curving slightly forward to juncture with the latter. Anterior median apodeme strong and distinct from its anterior extremity at juncture of apodemes I to point slightly posterior to mesal terminations of apodemes II, continuing weakly to juncture with transverse apodeme. Apodemes III extending in anteromedial directions from anterior condyles of coxae III for a distance equal to one half length of coxa III, anterior half of apodemes expanded, fan-shaped, these extremities widely separated from each other. Apodemes IV weak but conspicuous, subparallel to apodemes III, extending from points near inner margins of coxae III in line with posterior fourth of segments to juncture with median apodeme at a point in transverse alignment with anterior eighth of coxae III. Posterior median apodeme weak, seen only as a thin line extending from point of juncture of apodemes III to a point slightly behind posterior extremities of coxae IV, not continuous for its entire length. A weak but conspicuous median dorsal apodeme extends in interrupted manner from anterior third of propodosoma almost to main body suture, strongest near its posterior extremity. Five transverse sutures visible on hysterosoma, the first inconspicuous and transecting body near anterior extremities of coxae III, the second conspicuous and near mid-lengths of coxae III, the third

at coxae IV and the remaining two dividing opisthosoma into three segments. Dorsum of propodosoma narrowed and projected anteriorly to form a cephalothoracic hood with its anterior margin truncate and slightly broader than capitulum, the hood projecting only over basal tenth of capitulum. Pseudostigmatic organs as long as tarsus II, with broadly oval apices twice as long as slender pedicels. Stigmatal openings distinct, situated dorsally on lateral margins of propodosoma the basal width of tibiotarsus I behind anterolateral extremities of hood. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae as long as capitulum, situated on anterolateral angles of cephalothoracic hood; second pair of setae one and one-half times as long as setae of first pair, located midway between anterolateral margins of hood and main body suture. Of the six pairs of dorsal hysterosomal setae the first pair are the longest, being slightly longer than the first propodosomals, the sixth pair are the strongest and nearly as long as the first pair, remaining pairs subequal in size. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as basal width of tarsus II, located slightly anterior to apodemes I just before anterolateral extremities of these apodemes; second pair of setae slightly longer than setae of first pair, situated on apodemes II at their mid-lengths. First pair of ventral hysterosomal setae as long as second propodosomals, located just mesad from the broad anterior extremities of apodemes III; second ventral hysterosomal setae as long as first ventral hysterosomals, located on apodemes IV near their posterior extremities; third hysterosomals very short, situated near apex of opisthosoma. *Capitulum*: Subcordate with posterior margin deeply emarginate; length including projecting palpi, 31 μ ; greatest width, measured at posterior third, 23 μ . Dorsal setae with length equal to one half width of capitulum, located near anterolateral margins of capsule. Ventral setae slightly shorter than dorsal setae, situated near bases of palpi. Palpi moderately long and robust, projecting beyond apex of capitulum, indistinctly segmented and ornamented. Chelicerae projecting between but not beyond palpi; cheliceral sheaths without striae. *Legs*: Anterior pairs moderately long and stout, subequal in size. Leg I with coxa subquadrangular, broader than long, without setae; femur one and one-half times as long as broad, tapered slightly toward apex, with one stout, lanceolate seta situated dorsally near outer apical margin, two normal setae; genu two thirds as long as broad at base, with three setae; tibiotarsus nearly as long as femur, tapering slightly from base to

broadly rounded apex, with one clavate, annulated, sensory seta having length equal to one third basal width of segment, situated dorsally on outer margin one third length of seta from base of segment, one capitate sensory seta slightly longer than clavate seta, situated ventrally near outer margin one half length of seta from base of segment, one spinelike seta one and two thirds times as long as clavate seta, situated just mesad from capitate seta, one large, clavate, annulated seta having length equal to two thirds basal width of segment, situated dorsally near outer margin at about mid-segment, seven normal setae and one long, tactile seta as long as combined lengths of tibiotarsus and pretarsus; tibiotarsus surmounted by a short, broad pretarsus bearing a broad empodium and a long, strong, curved claw. Leg II with coxa subquadrangular; broader than long, without vestiture; femur subequal in size to femur I, with three setae; genu one half as long as femur, as broad at base as long, with one stout, spinelike seta as long as segment, situated dorsally near inner margin at base of segment, two normal setae; tibia slightly longer than broad, with four setae; tarsus as long as tibia, tapering from broad base to narrowly rounded apex, with one clavate, annulated seta having length equal to basal width of segment, located middorsally near base of segment, one short, stout, spinelike seta with length equal to two thirds basal width of segment, located dorsally near outer margin at base of segment, three normal setae; tarsus surmounted by a short pretarsus bearing at its apex two long, curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa slender, elongate, more than four times as long as broad, length equal to combined lengths of femur, genu, tibia and tarsus II, without vestiture; femur one half as long as coxa, basifemur expanded, bulbous and separated from telofemur by an incomplete suture, telofemur expanding from base to apex and twice as long as basifemur, the former with one seta; tibia four fifths as long as femur, with four setae, three of which are near apex of segment the remaining seta at about mid-segment; tarsus slender, elongate, sides subparallel, segment as long as tibia, with three setae; tarsus surmounted by a short pretarsus with imbricated margins and bearing at its apex two long, curved, spreading claws between and beyond which projects a broad empodium. Leg IV with coxa small, subquadrangular, one and one half times as long as broad, without vestiture; trochanter collarlike, broader than long, without setae; third segment slender, elongate, sides subparallel, segment three fifths as long as coxa III,

with one ventral seta two fifths as long as segment, located near outer margin just before base, one stout, ventral seta one fourth as long as segment, located ventrally near outer margin one half length of seta from apex; fourth segment one fourth as long as third segment, with one stout, ventral seta nearly three times as long as segment, located just distad from mid-segment, one slender terminal seta as long as leg IV. *Measurements*: Apex of palpi to tip of opisthosoma, 264 μ ; anterior margin of cephalothoracic shield to tip of opisthosoma, 237 μ ; anterior extremity of shield to main body suture, 58 μ ; width of body at main body suture, 106 μ ; width of body at anterior condyles of coxae III, 117 μ ; distance between anterior condyles of coxae III, 57 μ .

Types: Arlington Farm, Virginia, Feb. 5, 1935, F. F. Smith, on sugarcane.

Location of types: U. S. National Museum, slides numbered 1123 and 1123-A (as indicated below).

The above descriptions of both sexes were made from specimens of the cotype series which, on U.S.N.M. slide no. 1123, included one male and six females and which were remounted from Ewing's original type slide by the present author. These types, the male specimen of which is hereby designated lectotype (slide no. 1123-A), are deposited in the U. S. National Museum. The remaining specimens of the cotype series mounted on a single slide and including three males and several females are also in the U. S. National Museum.

Males of this species resemble most closely *T. setifer* from which it may be distinguished by the second pair of dorsal hysterosomal setae being longer than the setae of the first pair, the reverse being true in *T. setifer*, the second pair of ventral hysterosomal setae being situated on apodemes IV rather than in the interapodemal area as in *T. setifer* and the dorsal setae of femora IV being longer than either of the ventral setae, these being shorter than one of the ventral setae in *T. setifer*. In addition to details in the chaetotaxy of tibiotarsus I which differentiate the females of these two species, they may be further distinguished by differences in the transverse apodeme which is uninterrupted in *T. randsi*.

Comparisons of types made in this study indicate that *T. iowensis*, which was described by Ewing from three female specimens, is identical to *T. randsi*.

Tarsonemus smithi Ewing

(Plates 9, 19 and 23)

Tarsonemus smithi Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 18.*Tarsonemus femoralis* Ewing, 1939, U. S. Dept. Agr., Tech. Bull., 653, p. 38.
(new synonymy).*Tarsonemus biungulatus* Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 50.
(new synonymy).

Male: Body elongate oval, broadest between main body suture and legs III, sides of body tapering gradually to apex of capitulum and rather abruptly to apex of genital papilla. Apodemes well-defined and conspicuous. Apodemes I as long as width of femur I, converging from inner angles coxae I to point of juncture with median apodeme. Anterior median apodeme extending caudad to point the width of tibia I before main body suture, terminating abruptly, its continuity broken for a short distance in region of convergence of apodemes II. Apodemes II extending from inner angles of coxae II in posteromedial direction, terminating abruptly just before convergence. Transverse apodeme well defined, transecting body as an uninterrupted line just anterior to main body suture. Posterior apodemes distinct, those of legs III extending from anterior coxal condyles of legs III in anteromedial directions almost two thirds the distance to main body suture at which point apodemes turn inward at ninety degree angle to juncture with apodemes IV. Apodemes IV extending anteriorly in directions nearly parallel to apodemes III making ninety degree turn just behind anterior extremities of apodemes III and connecting with posterior median apodeme. Posterior median apodeme extending from point behind main body suture a distance equal to combined lengths genu and tibia II to inner angles of coxae IV the apodeme forked at its posterior third. Interapodemal areas defined by posterior apodemes broadest posteriorly, truncate anteriorly. Cephalothoracic shield absent. *Dorsal chaetotaxy:* Propodosoma with first three pairs of setae arranged in a longitudinal row, setae of fourth pair situated laterad to setae of third pair; first pair of setae with length equal to combined lengths of femur and genu of leg I, located one third the length of seta behind and slightly medial to anterolateral angles of propodosoma, setae separated from each other by a distance equal to two thirds length of seta; second pair of setae slightly shorter than first pair, located one half length of seta behind first pair, separated from each other by distance slightly less than length of seta; third pair of setae very long, length equal to width of body at main body suture, located one half length of

seta of second pair behind and slightly laterad to these setae; fourth pair of setae subequal in length to setae of first pair, located one fourth length of seta laterad to third pair of setae. Hysterosoma with first pair of setae subequal in size to second pair propodosomal setae, located on lateral margins of body midway between anterior condyles of coxae III and main body suture; second pair of setae one and one-half times as long as first pair, situated on lateral margins of body in line with anterior fourth of coxae III; third pair of dorsal hysterosomal setae slightly longer than second pair, located slightly posterior and mesad to second pair, one half the length of seta from lateral margins of body; fourth pair of setae with length equal to one half greatest width of genital papilla, located immediately beside lateral margins of papilla at its anterior third. *Ventral chaetotaxy*: Propodosoma with first pair of setae as long as genu I, located the length of seta behind anterior extremities of apodemes I; second pair of setae subequal in length to first pair, located the length of seta behind mid-lengths of apodemes II. Hysterosoma with first and second pairs of setae located in interapodemal areas defined by apodemes III and IV; first pair as long as tibia III, located one fourth the distance from apodeme III to apodeme IV, two thirds the length of seta from anterior extremities of interapodemal areas; second pair of setae slightly longer than first pair, located close to apodemes IV a distance one and one-fourth times length of seta from posterior extremities of apodemes IV. *Capitulum*: Length including palpi, 34μ , width, 27μ ; cordate, with posterior margin truncate; median dorsal longitudinal apodeme extending the length of capitulum; a pair of dorsal apodemes extending from points near lateral margins at basal third in posteromedial direction, converging with median apodeme just before its posterior extremity; dorsal setae with length equal to width of tibia I, situated near apex of capitulum and separated from each other by a distance one and one-half times length of seta; palpi two-segmented, palpal setae as long as dorsal setae, located near outer apical margins of basal segments, palpi extending beyond apex of capitulum; chelicerae projecting slightly beyond apex of capitulum; cheliceral sheaths with conspicuous circular or spiral, strandlike thickenings. *Legs*: Anterior pairs of similar size and shape, elongate robust. Leg I with coxa subquadrangular about as broad as long, without vestiture; femur twice as long as broad at apex, lateral margins subparallel, with four normal setae; genu two thirds as long as femur, one and one-half times as long as broad, lateral margins subparallel, with four normal setae; tibia nearly one and one-half times as long as

genu, twice as long as broad, lateral margins subparallel, with one clavate, annulated seta with length equal to two thirds width of segment, located dorsolaterally on outer margin at basal fourth, five normal setae; tarsus about equal in length to tibia, four times as long as broad at base tapering from base to broadly rounded apex, with one lanceolate, annulated seta one half as long as segment located dorsally on outer margin near base of segment, seven normal setae; tarsus surmounted by large, single, curved claw projecting beyond a broad circular empodium. Leg II with coxa subquadrangular, slightly longer than broad at base, without setae; femur slightly larger but similar in shape to femur I, with three setae; genu one half as long as femur, slightly longer than broad, sides subparallel, with three setae; tibia one and one-half times as long as genu, twice as long as broad, lateral margins subparallel, with four normal setae; tarsus about as long as tibia, three times as long as broad at base, tapering to broadly rounded apex, with one lanceolate, annulated seta with length equal to one and one-half times basal width of segment, located dorsally near outer margin at base of segment, one small, stout, pointed bristle with length about one half the basal width of segment, located on outer margin the length of bristle from base of segment, four normal setae; tarsus surmounted by a slender pretarsus, as long as basal width of tarsus, bearing at its apex two strong, spreading, curved claws between and beyond which projects a broad empodium. Legs III with coxae widely separated, their posterolateral angles projecting beyond body margins, subtriangular in shape, slightly more than one and one-half times as long as broad at apex, without vestiture; basifemur distinct, subglobose, as broad as long, without setae; femur about twice as long as broad at apex, expanded slightly toward apex, with one seta; genu one and one-half times as long as broad, lateral margins slightly divergent from base to apex, with three setae; tibia one and one-half times as long as genu, three times as long as broad, lateral margins subparallel, with four normal setae; tarsus as long as tibia, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a narrow pretarsus bearing two strong, spreading, curved claws and a large subcircular empodium. Leg IV with coxa subquadrangular, nearly twice as broad as long, with one seta with length equal to two thirds width of segment situated ventrally near outer margin at apical third of segment; femur with length two and one-half times width of coxa, outer margin slightly convex, inner margin greatly convex on basal three fourths of segment, apical fourth narrow, with one dorsal seta one third as long as

segment located near outer margin at apical third, one seta with length slightly more than one third greatest width of segment located ventrally on inner margin at basal third, one seta with length slightly greater than one third length of segment located ventrally on inner margin two thirds the length of seta from apex of segment; tibia elongate, one third as long as femur, almost three times as long as broad at base, inner margin deeply convex, one seta one half as long as segment located dorsally near outer margin at apical third, one long, tactile seta, twice as long as segment, located mid-ventrally at apical fourth of segment; tarsus small, as broad as long, slightly less than one fourth as long as tibia, with one seta one and one-half times as long as segment located dorsally near inner margin at apical third of segment, one minute bristle one half as long as segment located dorsally near outer margin at apex, one ventral seta as long as segment situated near inner margin at apical third; tarsus terminating in a strong, broad, curved claw one-half as long as tibia. *Genital papilla*: Length, 29 μ , width, 30 μ ; subcordate, anterior margin deeply emarginate, posterior margin rounded truncate, projecting beyond tip of opisthosoma.

Measurements: Length from tip of capitulum to apex of genital papilla, 180 μ ; main body suture to apex of genital papilla, 105 μ ; width at main body suture, 79 μ ; width of body at coxae III, 90 μ .

Female: Body broadly oval, broadest at mid-length. Anterior apodemes distinct, those of legs I as long as width of genu II, converging on median apodeme which extends posteriorly as a faint line nearly to main body suture. Apodemes II as long as tarsus II, extending in posteromedial directions from inner angles of coxae II to points a distance equal to basal width of tarsus II laterad from median apodeme. Transverse apodeme distinct for its complete length, extending nearly to margins of body. Posterior apodemes distinct, those of legs III about one half as long as coxae III, extending from anterior coxal condyles of legs III in anteromedial directions, terminating at points one half the distance from coxal condyles to posterior median apodeme. Apodemes IV extending from point of juncture with median apodeme in line with anterior extremities of coxae III in directions toward inner apices of coxae III terminating at two thirds this distance. Anterior extremity of posterior median apodeme located one half length of coxa III behind main body suture, the apodeme extending caudad to point in line with posterior extremities of apodemes III. Hysterosoma transected by six sutures dividing this portion of body into seven segments;

segment defined by main body suture and first hysterosomal suture more than one third total length of hysterosoma. Cephalothoracic shield broadly rounded anteriorly, covering basal half of capitulum. Pseudostigmatic organs short, entire length including pedicel equal to length of tibia II, expanded apex broad, oval, about one and one-half times as long as greatest breadth, pedicel narrow, two thirds as long as apex, basal areolus with two clearly defined semicircular sclerotized areas separated by a median cleft. Stigmatal openings distinct, situated dorsolaterally between pseudostigmatic organs and anterior margin of cephalothoracic shield, the small circular openings situated on elevated tubercles; tracheae distinct as narrow tubes extending from stigmatal openings to vicinity of coxae IV, without bilobed expansions or atrial pouches. *Dorsal chaetotaxy:* Propodosoma with first pair of dorsal setae as long as width of capitulum, situated near anterolateral margins of cephalothoracic shield between stigmata and apex of shield; second pair of setae with length equal to half width of body at main body suture, located slightly more than half distance from stigmata to main body suture, about one third length of seta from lateral margins of body. Hysterosoma with first pair of setae about as long as tibiotarsus I, located on lateral margins of body two thirds the length of seta behind main body suture; setae of second pair slightly shorter than first pair, located one and one-half times length of seta from lateral body margins, about the length of seta anterior to first hysterosomal suture, this position being in front of and slightly laterad to anterior condyles of coxae III; third pair of setae with length subequal to second pair, located about twice length of seta from lateral margins of body between third and fourth hysterosomal sutures; fourth and fifth pairs of setae of about equal length, as long as third pair, located on penultimate segment of hysterosoma, outermost pair situated on lateral margins of body just behind fifth hysterosomal suture, inner pair located midway between fifth and sixth sutures the length of seta laterad from middorsum; sixth pair of setae as long as fifth pair, located on lateral margins of body near base of apical hysterosomal segment. *Ventral chaetotaxy:* First pair of setae minute, length equal to basal width of tarsus II, located the length of seta behind middles of apodemes I; second pair of setae as long as tarsus II, located on posterior margins of apodemes II at their mid-lengths. Hysterosoma with first pair of setae as long as apical segment of leg IV, located a distance two thirds the length of seta behind main body suture and the length of seta laterad from

mid-body; second pair of setae slightly shorter than first pair, situated at caudal extremities of apodemes III; third pair of ventral hysterosomal setae as long as basal width of tibia III, located at tip of abdomen and separated from each other by a distance equal to one and one-half times length of seta. *Capitulum*: Length including palpi, 35μ ; width, 26μ ; caudal margin rounded, truncate; dorsal setae with length equal to basal width of tibiotarsus I, located just behind apex of capitulum, separated from each other by a distance equal to one and one-half times length of seta; palpi two-segmented, projecting beyond apex of capitulum; ventral setae as long as dorsal setae; chelicerae projecting slightly beyond apex of capitulum; cheliceral sheaths with transverse striations as in the male. *Legs*: Anterior pairs elongate, robust. Leg I with coxa subtriangular, broader than long, without setae; femur three times as long as broad at apex, tapering from base to apex, outer margin strongly convex at basal third, a ridgelike expansion extending along ventral surface from inner margin at apical fourth diagonally across segment to outer basal angle, with three normal setae; genu one and one-half times as long as broad, with three setae; tibiotarsus twice as long as genu, tapering from base to apex, with one long, tactile seta one and one-third times as long as segment located dorsally on outer margin one half length of seta from base, one elongate, lanceolate, annulated seta with length equal to basal width of segment located dorsally near outer margin at mid-segment, one seta one third as long as segment located dorsally near inner margin at basal fourth of segment, one seta two thirds as long as segment located mid-dorsally at apical third, one seta two thirds length of segment located middorsally at apex, one seta as long as basal width of segment located ventrally near outer margin half length of seta from base, one seta one half as long as segment situated ventrally near inner margin at basal third, one seta one third as long as segment located on inner margin at basal third, one seta one third as long as segment located near inner margin at apical third, one broad seta nearly one half length of segment located ventrally near outer margin at apex of segment; tarsus surmounted by a short pretarsus bearing a small empodium beyond which projects a strong, curved claw. Leg II with coxa subquadrangular as broad as long, without vestiture; femur short, slightly longer than broad, with three normal setae; genu slightly longer than broad, with one strong, lanceolate seta, as long as segment, located dorsally near inner margin at base of segment, two normal setae; tibia one and one-half times as long

as broad, with four normal setae; tarsus nearly one and one-half times as long as tibia, tapering from base to apex, with one mid-dorsal peglike seta having length equal to one half basal width of segment, located at base of segment, one clavate, annulated seta as long as basal width of segment, located dorsally near inner margin at base, four normal setae; tarsus surmounted by a narrow pretarsus supporting two strong, spreading, curved claws between and beyond which projects a broad empodium. Leg III with coxa narrow, elongate, nearly four times as long as its greatest breadth, inner and outer margins convex, segment as long as combined lengths of genu and tibiotarsus I, anterior condyle situated midway between apex of segment and main body suture, without vestiture; femur about two thirds as long as coxa, basal fourth bulbous, lateral margins divergent from basal fourth to apex, segment with three setae; tibia slightly longer than femur, nearly two thirds as long as coxa, tapering slightly from base to apex, segment with four setae; tarsus narrow, elongate, three-fourths as long as tibia, lateral margins subparallel, segment with three setae; tarsus terminating in a narrow pretarsus having length nearly equal to twice width of tarsus and bearing at its apex two strong, spreading, curved claws between which projects a broad empodium. Leg IV with coxa small subquadrangular, slightly longer than broad, without setae; trochanter small, collarlike, as broad as long, without vestiture; third segment narrow, elongate, its length equal to transverse distance between anterior coxal condyle of leg III and median apodeme, with one ventral seta one-fourth as long as segment, located the width of segment from base, one stout seta one-half as long as segment located ventrally one fourth length of seta behind apex; fourth segment about one third as long as third segment, with one stout, ventral seta twice as long as segment, located the width of segment before apex, one seta longer than leg IV located at apex of segment. *Measurements:* Apex of cephalothoracic shield to tip of opisthosoma, 175 μ ; tip of shield to main body suture, 49 μ ; width at main body suture, 84 μ ; width of body at anterior coxal condyles of legs III, 95 μ ; distance between anterior coxal condyles of legs III, 52 μ .

Types: Rosslyn, Virginia, Oct. 31, 1933, F. F. Smith, black raspberry.

Location of types: United States National Museum No. 1118.

The type slide, U.S.N.M. number 1118, contains ten mite specimens all of which are in poor condition. This series has been identified by the present author as follows: One male *T. randsi*, one male

T. smithi, five female *T. confusus*, one *T. smithi* female in fairly good condition, one unidentifiable female in very poor condition and one female "pupa." From this series the male *T. smithi*, recognizable by its dilated hind femora, is hereby designated lectotype.

Material examined by the present writer in addition to the type series included specimens with the following data: De Faures, Puyallup, Wash., Oct. 15, 1934, Wm. W. Baker, chrysanthemum; De Faures, Puyallup, Wash., Oct. 11, 1934, Wm. W. Baker, *Ribes sanguineum*; De Faures, Puyallup, Wash., Oct. 13, 1934, Wm. W. Baker, *Althaea rosea*; Lawrence, Kansas, Aug. 1, 1949, R. E. Beer, *Rosa* sp.

The males of this species are rather easily distinguished by the expanded basal portion of femur IV and the females by the nature of the ventral apodemes and the specialized seta of genu II in addition to details of chaetotaxy of tibiotarsus I. In general appearance it most closely resembles *T. setifer*.

As indicated by Ewing (1939), who first pointed out the possibility of synonymy, this species has as a synonym *T. femoralis* which was described by the above author from a single male specimen. The holotype of *T. femoralis* was compared with the type of *T. smithi* by the present writer, who is in agreement with Ewing's suggested synonymy. Studies have also led the present author to conclude that *T. biungulatus*, which was described by Ewing from a single female specimen and which had the striking characteristic of two claws on tibiotarsus I, is in reality a synonym of *T. smithi*. The type specimen of *T. biungulatus*, because of the position of the mite on the slide, appears on casual examination to have two claws on leg I. Careful study, however, revealed this not to be the case and further that it resembles in all characteristics the type female of *T. smithi*.

Tarsonemus dispar, new species

(Plates 8, 19 and 23)

Male: Body oval, tapering abruptly from main body suture to capitulum and more gently from suture to genital papilla; broadest at main body suture; legs moderately long and stout; apodemes clear and well defined; capitulum smaller than genital papilla. Apodemes I as long as basal width of tarsus I, extending in postero-medial directions from inner condyles of coxae I converging medially at anterior extremity of median apodeme. Apodemes II subparallel to apodemes I and four times as long as the latter, extending from inner anterior condyles of coxae II to juncture with me-

dian apodeme. Transverse apodeme strong and distinct, extending in smooth arc connecting posterior condyles of coxae II. Anterior median apodeme strongest between apodemes I and II but distinct for its entire length, extending from point of convergence of apodemes I to point of intersection with transverse apodeme just anterior to main body suture. Apodemes III strong and broad, extending in a smooth arc from anterior condyles of coxae III to points of intersection with apodemes IV slightly behind main body suture. Apodemes IV not as broad as apodemes III but clearly defined for their entire lengths, extending in anteromedial directions from anterolateral condyles of coxae IV to point of intersection with apodemes III, the width of tarsus I from midline, recurved at this point forming scalloped anterior margin for the interapodemal areas delimited by apodemes IV and the median apodeme. Posterior median apodeme extending from Y-shaped juncture of apodemes IV slightly behind main body suture to a point in line with anterolateral condyles of coxae IV, distinct for its entire length. A strong hysterosomal suture transects body at anterior extremities of coxae IV, distinct both dorsally and ventrally. Propodosomal shield narrowly and angularly truncate at its anterior extremity, projecting to cover basal sixth of capitulum dorsally. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae stout, slightly longer than capitulum with its projecting palpi, situated just behind anterolateral extremities of propodosoma; second pair of setae about one-third as long as setae of first pair, situated twice length of seta behind and slightly laterad from first setae; third pair of setae slightly longer than greatest width of body, located one and one-half times length of second seta behind and slightly laterad from second setae; fourth pair of setae slightly longer than setae of second pair, nearly in linear arrangement with others, located one half length of seta behind and laterad from third setae. First pair of dorsal hysterosomal setae subequal in size to first propodosomals, located near margins of body two thirds length of seta behind main body suture; second, third and fourth pairs of setae subequal in size, about one half as long as first hysterosomals, third and fourth pairs located very close to genital papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae small, about one half as long as second dorsal propodosomals, located the length of seta laterad from Y-shaped juncture of apodemes I; second propodosomals twice as long as setae of first pair, located two thirds length of seta behind apodemes II at their mid-lengths. First pair of ventral hysterosomal setae as

long as second propodosomals, located on inner margins of apodemes III the length of seta before intersection of apodemes III and IV; second hysterosomal setae slightly longer than first ventral hysterosomal, located on apodemes IV twice length of seta before posterior extremity of apodeme. *Capitulum*: Small, subcordate, posterior margin rounded truncate; length including projecting palpi, 26 μ .; greatest width, 19 μ .. Dorsal setae with length slightly greater than half width of capitulum, located near anterolateral margins of cephalic capsule and separated from each other by a distance equal to length of seta. Ventral setae one half as long as dorsal setae and slightly more approximate to one another. Palpi short and slender, projecting a short distance beyond apex of capitulum, indistinctly segmented and ornamented. Chelicerae short, styliform, projecting slightly beyond tips of palpi, cheliceral sheaths without striae. *Legs*: Anterior pairs subequal in size, moderately long and stout, legs III more slender, legs IV of moderate size. Leg I with coxa subquadrangular, nearly twice as broad as long, without vestiture; femur short and stout, nearly as broad as long, with three short and one long setae; genu broader than long, with four setae; tibia as broad as long, length equal to length of genu, with one peg-like sensory seta nearly as long as segment, located dorsally on outer margin at basal third of segment, one capitate sensory seta two thirds as long as peglike seta, situated dorsally beside the latter, one short clavate, annulated seta as long as capitate seta, located dorsally slightly mesad to the capitate seta, four normal setae and one long tactile seta; tarsus twice as long as tibia, tapering from base to broadly rounded apex, with one short, clavate, annulated sensory seta having a length equal to one half basal width of segment, located dorsally near outer margin the length of seta from base of segment, seven normal setae; tarsus surmounted by a short, broad pretarsus bearing at its apex a strong, curved claw and a broad empodium. Leg II with coxa large and subquadrangular, nearly twice as broad as long, without setae; femur two thirds as broad as long, slightly larger than femur I, with two setae; genu as broad as long, with three setae; tibia as long as genu, tapering slightly from base toward apex, with four setae; tarsus slightly longer than tibia, tapering from base to broadly rounded apex, with one clavate, annulated, sensory seta as long as basal width of segment, located dorsally near inner margin one half length of seta from base of segment, one lanceolate seta as long as clavate seta, situated dorsally near outer margin one half length of seta from base of segment, one strong, spurlike projection extending from outer ventral margin of segment

just before apex, four normal setae on segment; tarsus surmounted by a short pretarsus bearing at its apex two large, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa broadly elongate, about three fifths as broad as long, length equal to combined lengths of femur and genu II, without vestiture; femur moderately long and stout, four fifths as long as coxa, about one half as broad as long, with one ventral seta; genu short, as broad as long, with three setae; tibia nearly twice as long as genu and twice as long as broad, with one clavate, annulated, sensory seta as long as width of segment, located dorsally at apical fifth of segment, three normal setae; tarsus as long as tibia, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a short pretarsus bearing apically a pair of strong, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa subtriangular, about as broad as long, with one ventral seta near outer margin, its length about one half length of segment; femur about twice as long as coxa, outer margin convex, inner margin with flangelike projection curving in smooth, slightly convex arc from mid-segment to apex, segment with one short dorsal seta having a length about equal to one fourth length of segment, situated near outer margin the length of seta before apex, one short ventral seta two thirds as long as dorsal seta, located near inner margin at mid-segment, one long ventral seta, one third as long as segment, located near inner margin the length of dorsal seta before apex of segment; tibia of moderate length, about one and one-half times as long as broad, with one peglike, annulated, sensory seta nearly as long as width of segment, located dorsally near outer margin at apical third of segment, one long tactile seta nearly as long as femur, located ventrally near inner margin at apex; tarsus slightly broader than long, with one dorsal seta twice as long as segment located near inner margin, one dorsal seta as long as segment, situated at mid-segment near apex, one ventral seta as long as segment, located near inner margin at basal third of segment; tarsus surmounted by a strong, curved claw, twice as long as tarsal segment. *Genital papilla*: Large and well-defined, subcordate with anterior margin rounded truncate and possessing a moderate medial emargination; posterolateral extremities extended as conspicuous, laterally projecting horns; papilla somewhat larger than capitulum. Length including projecting appendages, 26 μ ; greatest width, 23 μ . *Anal plate*: Situated ventrally immediately anterior to forward margin of genital papilla, its central disc ovate and with two short apodemes projecting from antero-

lateral extremities of disc. *Measurements:* Length of body from tips of projecting palpi to hind extremity of genital papilla, 158 μ ; width of body immediately behind main body suture, 94 μ ; anterior margin of propodosoma to main body suture, 50 μ .

Female: Body moderately elongate, oval, broadest immediately behind main body suture. Legs moderately long and of medium robustness, the anterior pairs widely separated from posterior pairs, coxae IV separated from each other by a distance equal to length of coxa IV. Apodemes distinct and clearly defined, those of legs I quite short, extending from innermost angles of coxae I in posteromedial directions, converging medially at anterior extremity of median apodeme. Apodemes II subparallel to apodemes I becoming indistinct some distance from median apodeme. Anterior median apodeme strongest between anterior extremity and point in line with medial extremities of apodemes II, indicated only faintly posterior to this point. Transverse apodeme absent. Apodemes III strongest near coxae III, extending in anteromedial directions from anterior condyles of coxae III in sweeping arcs recurved just behind main body suture and intersecting each other medially at anterior extremity of median apodeme, this point being the length of tarsus II behind main body suture. Apodemes IV extending in anteromedial directions from points just mesad to inner margins of coxae III at their posterior two fifths to intersection with median apodeme at its anterior third. Posterior median apodeme distinct from point of convergence of apodemes III to point in line with anterior extremities of coxae IV. Hysterosoma transected dorsally by three distinct sutures. Dorsum of propodosoma extended forward beyond stigmal openings to form a broadly rounded cephalothoracic hood, separated from remainder of propodosoma by a weak suture, which covers almost the entire capitulum. Stigmal openings conspicuous, situated dorsolaterally in depressions of lateral margins one third the distance from anterior extremity of cephalothoracic to main body suture. Pseudostigmatic organs spinelike, without expanded apices, length equal to length of genu II. *Dorsal chaetotaxy:* Propodosoma with first pair of setae having length equal to length of genu I, located near lateral margins of cephalothoracic hood at about its mid-length; second pair of propodosomal setae quite long, located the length of genu I before main body suture nearly twice this distance from lateral margins of body. Hysterosoma with six pairs of short setae, the first pair located laterally near main body suture, second and third pairs

situated near posterior margins of first and second hysterosomal segments respectively, fourth and fifth pairs located near posterior margin of third segment, sixth pair situated near posterior margin of fourth hysterosomal segment. *Ventral chaetotaxy*: Propodosoma with first pair of setae having length equal to two thirds basal width of tibiotarsus I, located one half length of seta laterad from Y-shaped juncture of apodemes I and median apodeme; setae of second pair slightly longer than first setae, located the length of latter behind apodemes II near mid-lengths of apodemes. First pair of ventral hysterosomal setae as long as second propodosomals, located on apodemes III near most anterior extension of the apodemal arcs, these points being the length of seta behind main body suture; second pair of setae as long as setae of first pair, located on apodemes IV near posterior extremities of apodemes; third pair of setae slightly longer than setae of second pair, located at apex of hysterosoma and separated from each other by their combined lengths. *Capitulum*: Subcordate, with posterior margin deeply and angularly emarginate; length including projecting palpi, 34μ ; greatest width, 26μ . Dorsal setae with length equal to one half width of capitulum, located near lateral margins at apical third of capsule. Ventral setae as long as dorsal setae and slightly more approximate to each other, located at about apical third of capitulum. Palpi narrow, elongate, indistinctly segmented and ornamented. Chelicerae short, styliform, not projecting beyond palpi; cheliceral sheaths not striate. *Legs*: Anterior pairs stout and of moderate length, subequal in size. Leg I with coxa subquad-rangular, slightly broader than long, without vestiture; femur one and one half times as long as broad, with two short setae and one long ventral seta; genu slightly longer than broad, about two thirds as long as femur, with four setae; tibiotarsus slightly longer than femur, three times as long as broad at base, tapering from base to broadly rounded apex, with one clavate, annulated, sensory seta having a length nearly equal to one half basal width of segment, located dorsally on outer margin the length of seta from base of segment, one capitate, sensory seta nearly as long as clavate seta, situated ventrally beside the latter, one rodlike sensory seta as long as capitate seta, situated ventrally beside the latter, one large, clavate, annulated, sensory seta with length nearly equal to basal width of segment, located dorsally near outer margin at basal two fifths of segment, one short, spurlike process projecting from inner apical angle of segment, ten normal setae on segment; tarsus sur-

mounted by a short pretarsus bearing at its apex a large, broad empodium and a strong, curved claw. Leg II with coxa subquad-rangular, about as broad as long, without vestiture; femur short and stout, as broad as long, with three setae; genu broader than long, with three setae; tibia slightly longer than broad, with four normal setae; tarsus slightly longer than tibia, tapered from base to narrowly rounded apex, with one clavate, annulated seta having length equal to basal width of segment, located dorsally near outer margin at base of segment, one short, broadly conical seta with length equal to two thirds basal width of segment located on outer margin at about mid-segment, one short, stout, spurlike projection on inner apical angle of segment, four normal setae; tarsus surmounted by a short pretarsus which bears at its apex two large, curved, spreading claws between and beyond which projects a large, broad empodium. Leg III with coxa slender, elongate, its length slightly greater than combined lengths of femur, genu and tibia II, greatest width about one fourth length of segment, without vestiture; femur about one half as long as coxa, constriction with incomplete suture at basal third of segment, one short ventral seta near outer margin just distad from constriction, two ventral setae at apical fifth of segment; tibia slender, elongate, sides subparallel, one and one-fourth times as long as femur, three times as long as broad, segment with three setae; tarsus about three fifths as long as tibia, tapering slightly to broadly rounded apex, with a short spurlike projection on outer ventral margin at apex and four normal setae; tarsus surmounted by a short pretarsus bearing two strong, curved, spreading claws between and beyond which projects a broad empodium. Leg IV with coxa subtriangular, as long as telofemur III, nearly as broad as long, without vestiture; trochanter broader than long, length equal to one half length of coxa, without vestiture; third segment slender, elongate, slightly bowed, about five times as long as broad at base, nearly as broad at apex as at base, with one ventral seta one fourth as long as segment, located near outer margin just before base of segment; fourth segment slightly less than one half as long as third segment, with one stout ventral seta about twice as long as segment, located near outer margin at about mid-length of segment, one terminal seta very broad at base and one and one fifth times as long as leg IV. *Measurements:* Apex of cephalothoracic shield to tip of opisthosoma, 200 μ ; tip of shield to main body suture, 57 μ ; width of body at main body suture, 96 μ ; width of body at anterior condyles of coxae III, 108 μ .

Holotype: Male, near Baldwin, Kansas, Feb. 2, 1953, C. C. Hall, from *Popilius disjunctus* (Ill.).

Allotype: Female, same data as holotype.

Paratypes: One male and nine females, same data as holotype. Two males and four females, Lawrence, Kansas, Feb. 18, 1953, R. E. Beer, from *Popilius disjunctus* (Ill.)

Location of types: Holotype, allotype, one male and nine female paratypes in Snow Entomological Museum, University of Kansas. Two males and four females at U. S. National Museum.

This species is unique in having the pseudostigmatic organs of the female greatly reduced, a degree of specialization no doubt well suited for their peculiar habitats. Also the large cephalothoracic hood which covers most of the capitulum serves in distinguishing this sex from closely related forms. The males are easily distinguished from other species in the genus on the basis of characters of leg IV, the presence of a specialized sensory seta on tibia III and other less conspicuous details. The species seems to bear the closest resemblance to *T. laminifer*, *T. sulcatus* and *T. setifer*, and for this reason is placed in the *Setifer* Group.

Specimens have been collected thus far only from one habitat, namely, beneath the elytra of the passalid beetle, *Popilius disjunctus* (Ill.). Here they are found most abundantly in a small dorsal pocket of the elytron's anterolateral extremity. However, a few specimens were found walking about on both surfaces of the folded hind wings and on other inner surfaces of the elytra.

Tarsonemus sulcatus, new species

(Plates 10, 19 and 23)

Male: Body oval, broadest at mid-length; legs moderately long and stout; apodemes strong and well defined. Genital papilla somewhat smaller than capitulum. Apodemes I as long as genu I, extending in posteromedial directions from innermost angles of coxae I, converging medially to form a distinct Y-shaped juncture with anterior median apodeme. Apodemes II subparallel to apodemes I, extending from anterior basal condyles of coxae II to juncture with median apodeme. Anterior median apodeme distinct for its entire length, extending from juncture of apodemes I almost to main body suture. Transverse apodeme absent. Apodemes III strong and conspicuous, extending from anterior condyles of coxae III to a position the length of genu I behind main body suture, angularly recurved at this point and continuing to juncture with

apodemes IV. Apodemes IV conspicuous, linear, appearing as straight anteromesally directed lines, extending to positions slightly exceeding the length of genu I behind main body suture, curving in smooth arcs at this point and intersecting median apodeme at a point the length of tibia I behind main body suture. Posterior median apodeme conspicuous for its entire length, extending from juncture of apodemes IV to a point in line with mid-coxae III, bifurcate at this point and extending to suture which transects body at anterior extremities of coxae IV. Dorsum of propodosoma with anterior margin broadly truncate and projecting to form a hood which covers basal third of capitulum. *Dorsal chaetotaxy*: Propodosoma with four pairs of setae, the first three pairs in longitudinal linear arrangement. Setae of first pair about as long as combined lengths of femur and genu I, not widely separated being one-third length of seta from each other; second pair of setae about equal in size to setae of first pair, located about two thirds length of seta posterior to and slightly laterad from first setae; third pair of setae elongate, three times as long as second setae, situated about one half length of second seta behind and slightly laterad from these setae; fourth pair of setae about equal in size to setae of second pair, situated one third length of seta laterad from setae of third pair. First pair of dorsal hysterosomal seta slightly longer than first propodosomals, situated near body margins one half length of seta behind main body suture; second and third pairs of setae quite long, about twice as long as first propodosomals; fourth pair of dorsal hysterosomal setae short, about one half as long as first propodosomals, situated near anterolateral extremities of genital papilla and separated from each other by a distance equal to one and one-half times length of seta. *Ventral chaetotaxy*: First pair of setae on propodosoma with length equal to length of genu I, located one half length of seta behind and laterad from Y-shaped juncture of apodemes I and median apodeme; setae of second pair slightly longer than first setae, situated near centers of area delimited by apodemes II, median apodeme, main body suture and inner margins of coxae II. First pair of ventral hysterosomal setae as long as second propodosomals, located the length of seta behind anterolateral angles of apodemes III; second pair of setae slightly longer than setae of first pair situated in transverse line with anterior condyles of coxae III, two thirds the distance from these condyles to apodemes IV. *Capitulum*: Subcordate with posterior margin rounded truncate and possessing a slight indentation mesally; length including projecting palpi, 32μ ; greatest width, 29μ . Dorsal setae relatively short,

length less than one half width of capitulum, located on antero-lateral margins of capsule in line with basal third of palpus. Ventral setae slightly shorter than dorsal setae and slightly more approximate, situated in transverse line with dorsal setae. Palpi stout, of moderate length, indistinctly segmented and ornamented, projecting beyond apex of capsule. Chelicerae of moderate length, styliform, projecting between palpi and extending to apices of the latter; cheliceral sheaths with transverse striae. *Legs*: Anterior pairs moderately long and stout, legs I slightly longer than legs II; posterior pairs of moderate size. Leg I with coxa subquadrangular, broader than long, without vestiture; femur robust, about two thirds as broad as long, tapered slightly from base toward apex, with four setae; genu about as broad as long, one half as long as femur, with four setae; tibia one and one-fourth times as long as genu, slightly less than one and one-half times as long as broad, with one clavate, annulated seta having length equal to three fourths basal width of segment, located ventrally near outer margin just before base of segment, one short, clavate, annulated seta, one half as long as the former, situated dorsally near outer margin near base of segment, four normal setae; tarsus slightly longer than tibia, tapering from base to broadly rounded apex, with one long, lanceolate seta about one half as long as segment, located dorsally near outer margin at base of segment, eight normal setae; tarsus surmounted by a short pretarsus bearing a small empodium and a small, curved claw. Leg II with coxa subquadrangular, slightly broader than long, without vestiture; femur as broad as long, about two thirds as long as femur I, with four setae; genu slightly broader than long, with three setae; tibia one and one-fourth times as long as genu, with four setae; tarsus one and one-third times as long as tibia, tapering from broad base to narrowly rounded apex, with one lanceolate seta nearly as long as basal width of segment, located dorsally near inner margin at base of segment, one very short, broad, spinelike seta having length equal to one fourth basal width of segment, located dorsally near outer margin the length of seta from base of segment; tarsus surmounted by a moderately long, slender pretarsus bearing at its apex two curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa broad and elongate, sides diverging from anterior condyles to apical third of segment, length equal to twice greatest breadth of segment, without vestiture; femur three fifths as long as coxa, about twice as long as broad, segment bent outward at nearly a right angle near mid-length, with one seta; genu short, as broad as long, with three setae; tibia

one and one-half times as long as genu, with four setae; tarsus slightly longer than tibia tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a slender pretarsus about one third as long as tarsus and bearing at its tip two spreading, curved claws of moderate size between and beyond which projects a broad, bilobed empodium. Leg IV with coxa subquad-rangular, size subequal to coxa I, about two thirds as long as broad, with one ventral seta; femur nearly as long as combined lengths of genu, tibia and tarsus III, about two fifths as broad at base as long, outer margin slightly and evenly convex, inner margin greatly convex for basal two thirds of segment, straight at apical third, greatest width of segment at basal third at this point being one half as broad as long, segment with one dorsal seta having length slightly greater than basal width of segment, situated one third distance from outer to inner margin at about apical third of segment, one ventral seta as long as dorsal seta situated near inner margin at apical third, this point being at point of termination of dilated portion of segment, another ventral seta one-half as long as the former, located on inner margin at about basal fifth of segment; tibia moderately long and slender, about twice as long as broad at base, length equal to basal width of femur, with one dorsal, rodlike seta with length equal to width of segment, situated near outer margin at apical fourth, one long tactile seta, more than three times as long as segment and slightly longer than femur, situated near apex of segment; tarsus small, about one and one-half times as broad as long, with three short setae, one ventral, the other two dorsal; tarsus surmounted by a strong, curved claw, its length nearly equal to length of tibia. *Genital papilla*: Subcordate with anterior margin having a broad median emargination, posterior margin broadly rounded; length including projecting appendages, 24μ ; greatest width measured at anterior fifth, 23μ . *Measurements*: Length of body from tips of palpi to apex of genital papilla, 160μ ; greatest width, 99μ ; anterior margin of cephalothoracic hood to main body suture, 42μ ; main body suture to apex of genital papilla, 97μ ; width of body at main body suture, 78μ ; width at anterior apodemes of coxae III, 87μ .

Female: Body broadly and regularly oval, broadest at mid-length. Legs relatively short and stout, the anterior pairs widely separated from posterior pairs; legs III separated from each other by a distance equal to distance from posterolateral margins of coxae III to margins of body; inner margins of coxae IV separated by a distance equal to one and one-half times length of coxa IV. Apo-

demes indistinct, weak, not clearly defined, those of legs I as long as genu I, extending in posteromedial directions from innermost angles of coxae I converging medially to form Y-shaped juncture with median apodeme. Apodemes II subparallel to apodemes I for most of their lengths, curving gently in caudad directions just before intersecting median apodeme and losing definiteness shortly beyond these points. Transverse apodeme present but weak, extending in smooth, uninterrupted arc just anterior to main body suture, its lateral extremities indistinct but not contacting coxae II. Anterior median apodeme weak but continuous, extending from point of convergence of apodemes I almost to transverse apodeme. Posterior apodemes weak, those of legs III extending indistinctly in anteromedial directions from anterior condyles of coxae III, curving inward just behind main body suture and disappearing at points two thirds length of genu I behind this suture. Apodemes IV extending in anteromedial directions from outer anterior condyles of coxae IV directed toward intersecting median apodeme at its mid-length but becoming indistinct before juncture. Posterior median apodeme weak, extending from point in transverse line with anterior extremities of coxae IV to point the length of genu I behind main body suture, becoming bifurcate here, each arm of apodeme extending in anterolateral direction and disappearing after a short distance. Segmentation of hysterosoma pronounced, the first suture transecting body at about anterior third of coxae III, second suture at coxae IV, two sutures divide opisthosoma into three segments. Dorsum of propodosoma projected to form hood with a broadly rounded anterior margin, this hood covering posterior half of capitulum. Pseudostigmatic organs with length slightly greater than length of genu I, their pedicels about one third as long as the broadly oval apices, circular areoli with diameters equal to three fourths greatest width of expanded apices. Stigmatal openings not distinct, situated near anterolateral extremities of cephalothoracic hood. *Dorsal chaetotaxy*: First pair of propodosomal setae as long as tibiotarsus I, located one half length of seta behind anterior margin of propodosoma and separated from each other by a distance equal to length of seta; setae of second pair about as long as leg II situated the length of genu I in front of main body suture and separated from each other by a distance slightly less than length of seta. First pair of dorsal hysterosomal setae as long as tibiotarsus, setae of second pair slightly shorter, the remaining four pairs less than one half as long as second seta. *Ventral chaetotaxy*: First pair of ventral propodosomal setae small, length equal to basal width of tibiotarsus I,

located the length of seta in posterolateral direction from juncture of apodemes I; setae of second pair about one and one-half times as long as first setae, situated near centers of areas delimited by apodemes II, median apodeme, transverse apodeme and inner bases of coxae II. First pair of hysterosomal setae as long as second propodosomals located at points the length of seta behind main body suture, separated from each other by a distance equal to five times length of seta; second ventral hysterosomal setae subequal in size to setae of first pair, located on apodemes IV one and one-half times length of seta anterior to the subacute anterior extremities of coxae IV; third pair of setae small, located near apex of opisthosoma. *Capitulum*: Subcordate with posterior margin rounded truncate and possessing a shallow, medial emargination; length including projecting palpi, 30 μ ; greatest width, measured at basal fourth of capsule, 29 μ . Dorsal setae with length equal to two fifths greatest width of capitulum, situated near lateral margins at apical third. Ventral setae slightly shorter than dorsal setae, situated a bit more approximate to each other than are the dorsal setae and in transverse alignment with the latter. Palpi short, broad, indistinctly segmented and adorned, projecting a short distance beyond apex of capitulum. Chelicerae short, needlelike, not projecting beyond palpi; cheliceral sheaths without striae. *Legs*: Anterior pairs relatively short and stout. Leg I with coxa subquadrangular, broader than long, without vestiture; femur as broad as long, with four normal setae; genu as broad as long, with four setae; tibiotarsus three times as long as broad at base, tapering slightly to broadly rounded apex, with one long, rodlike, sensory seta having length nearly equal to one half basal width of segment, located ventrally one third length of seta from outer margin, this distance from base of segment, one clavate, annulated, sensory seta about one third as long as rodlike seta situated beside the latter, one clavate, annulated seta one half as long as rodlike seta, located beside the smaller clavate seta nearly on lateral margin of segment, one large, clavate, annulated seta with length nearly equal to one half basal width of segment located on lateral margin just proximad to mid-segment, one clavate, annulated seta with length about equal to one fourth basal width of segment, situated dorsally near outer margin at apical third, one short, spinelike seta, its length equal to one fourth basal width of segment, located ventrally near outer margin at apex. one tactile seta longer than segment located dorsally near outer margin at basal sixth, nine normal setae; tarsus surmounted by a

short, stout pretarsus bearing at its apex a strong curved claw and a small empodium. Leg II with coxa subequal in size to coxa I, without vestiture; femur similar in size and shape to femur I, with three setae; genu broader than long, with one stout, spinelike seta as long as segment, located ventrally near inner margin at base, two normal setae; tibia as broad as long, with four setae; tarsus as long as tibia, tapering from broad base to narrowly rounded apex, with one clavate, annulated sensory seta nearly as long as basal width of segment, located on inner margin at base of segment, one short, pronounced spurlike projection located ventrally near outer margin at apex, four normal setae; tarsus surmounted by a short, broad pretarsus bearing at its apex two strong, curved, spreading claws between which projects a broad empodium. Leg III with coxa elongate oval, slightly longer than tibiotarsus I, without vestiture; femur one half as long as coxa, basal third of segment bulbous, separated from telofemur by a distinct constriction and an incomplete suture, telofemur expanding from base to apex and bearing four setae three of which are situated on apical fourth of segment the other near constriction separating basifemur and telofemur; tibia as long as femur, sides slightly convex, with one seta at basal third and three at apical third of segment; tarsus three-fourths as long and one half as broad as tibia, sides subparallel for entire length of segment, with three setae; tarsus surmounted by a short, stout pretarsus bearing at its apex two strong, curved, spreading claws between which projects a broad empodium. Leg IV with coxa subtriangular, only slightly longer than broad, without vestiture, trochanter collarlike, broader than long, without adornment; third segment moderately slender, elongate, as long as tibiotarsus I, about one fifth as broad as long, tapering very slightly from base to mid-segment with margins parallel beyond this point, segment with one ventral seta one half as long as segment, located near outer margin one half width of segment before base, one ventral seta nearly as long as the latter located on outer margin the width of segment before apex; fourth segment one fifth as long as third segment, with one stout, ventral seta as long as third segment located near outer margin at apical third, one terminal seta with length equal to one and one-third times the length of subterminal seta, this equalling combined lengths of segments three and four. *Measurements*: Length of body from tips of palpi to apex of opisthosoma, 209 μ ; anterior margin of cephalothoracic hood to posterior extremity of opisthosoma, 189 μ ; tip of hood to main body suture,

47 μ ; width of body at main body suture, 106 μ ; width at anterior condyles of coxae III, 122 μ ; distance between anterior condyles of coxae III, 52 μ ; greatest distance between coxae IV, 12 μ .

Holotype: Male, Washington, D. C., Aug. 26, 1950, E. W. Baker, hibiscus.

Allotype: Female, same data as holotype.

Location of types: Snow Entomological Museum, University of Kansas.

Although this species was not available in series for study, the present writer feels that it is distinct enough for describing and naming at this time. The two type specimens are the only members of this species examined.

In general appearance this species resembles most closely *T. smithi* and *T. randsi*. In the males it is most readily distinguished from these and other members of the Setifer Group, except *T. laminifer*, by the elongate second and third dorsal hysterosomal setae. In *T. laminifer* the second ventral hysterosomal setae are situated on apodemes IV, whereas in *T. sulcatus* they are some distance laterad from these apodemes. The male hind leg is somewhat similar to that of *T. smithi* but differs from the latter species in having the tactile tibial seta relatively short. Females are distinguished from closely related forms on the basis of details in the chaetotaxy of tibiotarsus I. Also in this species the dorsal hysterosomal setae of pairs one and two are significantly longer than the other dorsal setae on this portion of the body.

Tarsonemus cryptocephalus (Ewing), new combination

(Plates 12, 19 and 23)

Pseudotarsonemoides cryptocephalus Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 9.

Male: Body broadly oval, broadest in line with anterior condyles of coxae III; apodemes distinct and well-defined; genital papilla considerably larger than capitulum; anal plate large and distinct. Apodemes I short, extending in posteromedial directions from innermost angles of coxae I, converging medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II subparallel to apodemes I for most of their lengths, extending from innermost angles of coxae II and curving to posterior just before convergence with median apodeme, terminating abruptly a short distance beyond the curves. Transverse apodeme strong and distinct, extending posteriorly from outer basal angles of coxae II for a short distance then curving to transect body without interruption

slightly anterior to main body suture. Anterior median apodeme strong and distinct for anterior half of its length becoming interrupted and indistinct posteriorly, extending from point of convergence of apodemes I almost to transverse apodeme. Apodemes III extending in anteromedial directions from outer anterior margins of coxae III for a distance equal to length of coxa III, curving inward at these points at nearly a right angle and continuing to junctures with apodemes IV, these anterior extremities of apodemes III being the width of genu II behind transverse apodeme. Apodemes IV subparallel to apodemes III, extending from anterolateral angles of coxae IV to juncture with apodemes III, curving abruptly mesad slightly beyond juncture and terminating just before uniting at mid-body. Posterior median apodeme distinct for its entire length, extending from point slightly behind mesal extremities of apodemes IV to point in line with outer anterior angles of coxae IV, apodeme bifurcating at this point with each arm continuing posterolaterally to inner angles of coxae IV. Dorsum of propodosoma extending forward to form a cephalothoracic hood which projects over basal two thirds of capitulum, anterior margin of hood broadly truncate, this margin being as broad as capitulum. *Dorsal chaetotaxy:* Propodosoma with first pair of dorsal setae slightly longer than combined lengths of genu and tibia II, situated on anterolateral angles of cephalothoracic hood; second pair of setae slightly longer than setae of first pair, located behind and slightly laterad from the latter a distance equal to the length of first seta; third pair of setae three times as long as setae of second pair, located directly behind the latter a distance equal to one half distance separating first and second setae; fourth pair of dorsal propodosomal setae three fourths as long as first setae and not as stout, situated laterad from third setae a distance equal to that separating second and third setae. Hysterosoma with first pair of setae nearly as long as first propodosomals, located on lateral margins of body the length of seta behind main body suture; setae of second pair one and two-thirds times as long as first hysterosomals; third pair of setae slightly shorter than second pair; fourth pair of dorsal hysterosomal setae one half as long as second setae, located near lateral margins of genital papilla near mid-length of papilla. *Ventral chaetotaxy:* First pair of ventral propodosomal setae short, length equal to basal width of tarsus I, located two thirds length of setae laterad from juncture of apodemes I; second pair of setae slightly longer than setae of first pair, situated the length of seta laterad from mesal extremities of apodemes II. First pair of ventral hystero-

somal setae as long as second ventral propodosomals, located near anterolateral extremities of interapodemal areas defined by apodemes III and IV; second pair of setae subequal in size to setae of first pair, situated one third length of seta laterad from apodemes IV at posterior two fifths of apodemes. *Capitulum*: Subcordate with posterior margin rounded truncate; length including projecting palpi, 35μ ; greatest width, measured at basal third of capsule, 23μ . Palpi moderately short and robust, indistinctly segmented and ornamented. Chelicerae styliform, projecting between but not beyond apices of palpi; cheliceral sheaths without striae. Dorsal setae with length nearly equal to one half width of capitulum, situated on anterolateral extremities of capsule. Ventral setae about one half as long as dorsal setae, located near bases of palpi and separated from each other by a distance slightly less than their combined lengths. *Legs*: Anterior pairs moderately long and robust, subequal in size. Leg I with coxa subquadrangular, broader than long, without vestiture; femur robust, one and one-half times as long as coxa, with two setae; genu as broad as long, with four setae; tibia twice as long as broad, with five setae; tarsus as long as tibia, with one short, clavate, annulated seta having length equal to basal width of segment, located dorsally near outer margin at base of segment, five normal setae; tarsus surmounted by a slender, elongate pretarsus bearing at its apex a curved claw and a broad empodium. Leg II with coxa subquadrangular, about twice as broad as long, without vestiture; femur robust, slightly longer than broad at base, with two setae; genu as broad as long, with four setae; tibia slightly longer than broad, with three setae; tarsus as long as tarsus I, tapering from base to narrowly rounded apex, with one short, clavate, sensory seta with length equal to two thirds basal width of segment, located dorsally near outer margin at base of segment, four normal setae; tarsus surmounted by a slender pretarsus bearing at its apex two curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa relatively short and broad, length equal to three fifths greatest width, as long as combined lengths of tibia and tarsus II, without vestiture; femur slightly longer than width of coxa, basifemur expanded, bulbous, separated from telofemur by an incomplete suture, telofemur with one seta; genu about one half as long as femur, slightly longer than broad, with three setae; tibia one and one-third times as long as genu, twice as long as broad, with three setae; tarsus as long as tibia, with four setae; tarsus surmounted by a slender, elongate pretarsus bearing at its apex two moderately sized, spread-

ing, curved claws between and beyond which projects a broad empodium. Leg IV with coxa subtriangular, slightly broader than long, with one long, ventral seta; femur moderately long and stout, length equal to combined lengths of genu, tibia and tarsus III, about one half as broad at base as long, width at apex nearly two thirds width at base, inner margin curved inward at nearly a right angle just before base of segment, dorsal seta with length equal to apical width of segment and located on outer margin the length of seta from apex of segment, one short ventral seta one half as long as dorsal seta, situated on inner margin at basal two fifths, one ventral seta two and one-half times as long as dorsal seta, situated near inner margin at apex of segment; tibia robust, length slightly greater than apical width of femur, three fourths as broad as long, outer margin strongly convex and about twice as long as concave inner margin, segment with one rodlike, sensory seta with length equal to apical width of segment, situated dorsally near outer margin at apical third, one long tactile seta as long as leg IV, situated ventrally near outer distal margin of segment; tarsus small, collarlike, twice as broad as long, with one small ventral seta and two small dorsal setae; tarsus surmounted by a strong, curved claw nearly as long as tibia. *Genital papilla*: Subcordate with anterior margin rounded and emarginate medially; length including projecting appendages, 40 μ ; greatest width, measured at anterior fourth of papilla, 32 μ . *Anal plate*: Large and conspicuous; central disc ovate, with greatest dimension equal to basal width of tarsus III, three strong apodemes radiating from disc each slightly longer than disc, with one extending caudally from posterior margin of disc and the remaining two extending anterolaterally from anterior margin of disc. *Measurements*: Total length, from tips of palpi to tips of appendages of genital papilla, 178 μ ; anterior margin of cephalothoracic hood to apex of genital papilla, 162 μ ; anterior margin of hood to main body suture, 46 μ ; width of body at main body suture, 79 μ ; greatest width of body, measured at anterior extremities of coxae III, 101 μ .

Female: Body short, oval, broadest at mid-length. Legs comparatively long and moderately stout; anterior pairs subequal in size; hind coxae widely separated, with distance between innermost angles of coxae IV only slightly less than twice width of coxa. Apodemes weak and indistinct, those of legs I slightly longer than genu I, extending in posteromedial directions from innermost angles of coxae I converging medially to form an indistinct Y-shaped juncture with anterior extremity of median apodeme. Apodemes II one

and one-half times as long as apodemes I and subparallel to the latter, extending from innermost angles of coxae II to points the width of genu I laterad from median apodeme, terminating here indistinctly. Transverse apodeme weak, extending in a smooth transverse curve which transects body at a point the length of tibiotarsus I behind mesal extremities of apodemes II, lateral extremities of transverse apodeme curving gently forward directed toward posterior basal angles of coxae II but terminating before reaching these coxae. Anterior median apodeme very weak from its anterior extremity at juncture of apodemes I to point in transverse alignment with mesal extremities of apodemes II, strong and conspicuous for a short distance in this area, losing visibility posterior from this point. Apodemes III strong and conspicuous for a short distance, extending anteromedially from anterior condyles of coxae III, losing distinctness just before contacting transverse apodeme. Apodemes IV indistinct for most of their lengths, extending anteromedially from points the basal width of tarsus II mesad from inner margins of coxae III at distal thirds of these segments to juncture with median apodeme opposite apical thirds of coxae III. Posterior median apodeme only visible for a short distance, extending in posterior direction from point of juncture of apodemes IV, terminating indistinctly at a point slightly posterior to apical thirds of coxae III. A faint suture transects propodosoma dorsally at its anterior third separating a broadly rounded cephalothoracic hood from remainder of propodosoma, the hood projecting over basal third of capitulum. Hysterosomal sutures distinct dorsally only in opisthosoma where three sutures transect the body clearly dividing opisthosoma into three distinct segments, the first of these sutures in vicinity of coxae IV, the remaining two situated to make the segments formed almost of equal length. Stigmatal openings small but distinct, situated dorsolaterally just posterior to suture separating cephalothoracic hood from remainder of propodosoma. Pseudostigmatic organs with expanded apices subspherical, these expansions with diameters slightly greater than length of slender pedicels; areoli with semi-circular basal plates with diameters nearly equal to diameters of expanded apices of organs, these plates densely punctate. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae stout, length equal to combined lengths of tibiotarsus and pretarsal elements of leg I, situated near anterolateral margins of cephalothoracic hood and separated from each other by a distance equal to length of seta; second pair of setae one and one-third times as long as leg II, situated the length of tarsus II from lateral margins of body slightly

less than one half the distance from stigmal openings to main body suture. First pair of dorsal hysterosomal setae nearly as long as first propodosomals but not as robust, situated on lateral margins of body the length of seta behind main body suture; second dorsal hysterosomals subequal in size to setae of first pair, situated in transverse alignment with anterior thirds of coxae III; third, fourth and fifth pairs of dorsal hysterosomal setae stout, subequal in size, about one half as long as second pair; sixth setae also stout but three fourths as long as second setae.

Ventral chaetotaxy: Propodosoma with first pair of setae having length equal to basal width of tibiotarsus I, situated one half length of seta laterad from Y-shaped juncture of apodemes I and median apodeme; second ventral propodosomal setae one and one-half times as long as setae of first pair, situated on apodemes II at their mid-lengths. First pair of ventral hysterosomal setae as long as second propodosomals located on transverse apodeme and separated from each other by a distance equal to their combined lengths; second pair of setae subequal in size to setae of first pair, situated on posterior extremities of apodemes IV; third pair of setae short, located near tip of opisthosoma. *Capitulum:* Subcordate with posterior margin slightly emarginate; length, including projecting palpi, 37 μ ; greatest width, measured at basal third of capsule, 30 μ . Dorsal setae with length equal to length of genu I, situated near antero-lateral margins of capsule and separated from each other by a distance equal to length of seta. Ventral setae slightly shorter than dorsal setae, located near bases of palpi and separated from each other by a distance equal to length of seta. Palpi short and stout, indistinctly segmented and ornamented. Styliform chelicerae projecting between and slightly beyond palpi; cheliceral sheaths without striae. *Legs:* Anterior pairs moderately long and stout, subequal in size. Leg I with coxa subquadrangular broader than long, without vestitures; femur robust, slightly longer than broad, with four setae; genu slightly longer than broad, with four setae; tibiotarsus robust, about twice as long as genu and three times as long as broad at base, with one short, clavate, annulated seta having length equal to one third basal width of segment, located dorsally near outer margin the length of seta from base of segment, one small, capitate seta nearly as long as the former, situated immediately mesad from the clavate seta, one short, rodlike seta slightly longer than clavate seta, situated immediately beside the capitate seta, one large, clavate, annulated seta having length equal to three fourths basal width of segment, situated dorsally near outer margin just distad

from mid-segment, one short, ventral, spurlike process projecting from inner apical margin of segment, ten normal setae on segment; tibiotarsus subtending a short, curved claw and a small empodium. Leg II with coxa subquadrangular, as broad as long, without vestiture; femur robust, as broad at base as long, with three setae; genu as broad as long, with one stout, spinelike seta as long as segment, situated dorsally near inner basal margin of segment, two normal setae; tibia one and one-half times as long as broad, with four setae; tarsus slightly longer than tibia, tapering from base to narrowly rounded apex, with one clavate, annulated seta as long as basal width of segment, located dorsally near outer margin one half length of seta from base of segment, three normal setae; tarsus surmounted by a short, broad pretarsus with lateral margins imbricated and bearing apically a pair of strong, curved, spreading claws between and beyond which projects a small empodium. Leg III with coxa broad and oval, its length equal to combined lengths of genu and tibiotarsus I, nearly one half as broad as long, without vestiture; femur one half as long as coxa, its basal third separated from distal portion by an incomplete suture, this basifemur subglobose and telofemur expanding from base to apex, the latter bearing three setae; tibia as long as femur, tapering slightly from mid-segment toward apex, with four setae; tarsus three fourths as long as tibia, one fifth as broad as long, sides subparallel for entire length of segment, with three setae; tarsus surmounted by a short, broad pretarsus with lateral margins imbricated in appearance, the segment bearing at its apex two strong, curved, spreading claws between and beyond which projects a small empodium. Leg IV with coxa subquadrangular, one and one-half times as broad as long, without vestiture; trochanter small, collarlike, nearly twice as broad as long, without setae; third segment slender, elongate, one and one-half times as long as tibia III, with one ventral seta one fourth as long as segment, located near outer margin the width of segment from its base, one ventral seta two thirds as long as segment, situated near outer margin at apical third; fourth segment one third as long as third segment, with one stout, ventral seta as long as third segment, situated at apical third of segment, one terminal seta nearly twice as long as leg IV. *Measurements:* Tips of palpi to apex of hysterosoma, 170 μ ; anterior extremity of cephalothoracic hood to apex of hysterosoma, 137 μ ; anterior extremity of hood to main body suture, 61 μ ; width of body at anterior condyles of coxae III, 93 μ ; distance between anterior condyles of coxae III, 54 μ ; distance between innermost margins of coxae IV, 14 μ .

Types: Collected at New York in shipment of avocados arriving from Chile, S. Am., July 3, 1934, Inman and Whitlock, collectors.

Location of types: Cotype series with the exception of two females in U. S. National Museum, these two specimens in Snow Entomological Museum, University of Kansas.

The above description of the male was made from a specimen in the U. S. National Museum series of cotypes. The description of the female was made from a cotype female now in the Snow Entomological Museum. The cotype series included several mites of both sexes on a single slide which have been remounted one mite per slide. One of these remounted male specimens, slide number 1117-A is hereby designated lectotype.

Specimens identified by the present writer as this species include only the cotype series.

Tarsonemus laminifer Ewing

(Plates 10 and 19)

Tarsonemus laminifer Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 37.

Male: Body broad, oval, broadest at posterior third; legs of moderate length, robust; apodemes strong and clearly defined; genital papilla large, nearly as large as capitulum. Apodemes I as long as tibia I, extending in posteromedial directions from innermost angles of coxae I, converging medially to form a Y-shaped juncture with median apodeme. Apodemes II one and one-half times as long as apodemes I and subparallel to the latter, extending from anterior basal condyles of coxae II, curving abruptly caudad just before intersection with median apodeme and terminating just beyond this point. Anterior median apodeme strong and distinct, extending from juncture of apodemes I almost to main body suture, its continuity broken for a short distance near median extremities of apodemes II. Transverse apodeme absent. Apodemes III strong and thickened, extending in anteromedial directions from anterior condyles of coxae III, curving inwardly at anterior thirds and slightly recurved just before intersecting apodemes IV. Apodemes IV distinct for entire lengths, extending from outer anterior angles of coxae IV to point of juncture with apodemes III a short distance behind main body suture, curved abruptly inward at this point to join with anterior extremity of median apodeme. Posterior median apodeme distinct for its entire length, extending from point one half length of tibia II behind main body suture to point in line with mid-lengths of coxae III, bifurcate at this point with each arm of

apodeme continuing to inner anterior angles of coxae IV. Dorsum of propodosoma with anterior margin broadly and angularly truncate projecting to cover only extreme posterior end of capitulum. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae as long as combined lengths of tibia and tarsus I, slightly longer than anterior margin of dorsal propodosomal shield, situated one fifth length of seta behind anterior margin of shield and separated from each other by this distance; setae of second pair slightly longer than first setae situated almost directly behind the latter a distance equal to one fifth length of second seta; third setae more than twice as long as second setae, situated behind and slightly laterad from setae of second pair a distance almost twice that separating first and second setae; fourth pair of dorsal propodosomal setae slightly longer than setae of second pair, located laterad from third setae a distance equal to one half the distance separating first and second setae. First pair of dorsal hysterosomal setae slightly longer than fourth propodosomals, located near margins of body one third length of seta behind main body suture; second and third hysterosomals quite long, five sixths as long as third propodosomals; fourth pair of dorsal hysterosomal setae about one half as long as first propodosomals, located near lateral extremities of genital papilla at its mid-length. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to length of genu II, located two thirds length of seta in posterolateral direction from juncture of apodemes I; second propodosomals with size subequal to setae of first pair, situated midway between apodemes II and main body suture slightly more than length of seta from median apodeme. First pair of ventral hysterosomal setae subequal in length to second ventral propodosomals, situated on apodemes III two thirds length of seta from point of juncture of apodemes III and IV; second hysterosomals with size equal to setae of first pair, situated on apodemes IV at posterior two fifths. *Capitulum*: Subcordate with posterior margin slightly emarginate. Length including projecting palpi, 24μ ; greatest width, measured at posterior third of capsule, 24μ . Dorsal setae short, length equal one third width of capitulum, located near anterolateral angles of capsule. Ventral setae one-half as long as dorsal setae, situated in transverse alignment with the latter and separated from each other by a distance equal to three times length of seta. Palpi short and stout, indistinctly segmented and ornamented, projecting beyond apex of capitulum for a short distance. Chelicerae elongate, styliform, extending a short distance beyond tips of palpi; cheliceral sheaths without striae. *Legs*: Leg

I with coxa subquadrangular, broader than long, without vestiture; femur slightly longer than broad, with three short and one long setae; genu about as broad as long, with four setae; tibia four fifths as broad as long, with one small, clavate, annulated sensory seta, its length nearly equal to one half basal width of segment, situated dorsally near outer margin the length of seta from base of segment, five normal setae; tarsus one and one-third times as long as tibia, three times as long as broad at base, tapering from base to narrowly rounded apex, with one lanceolate, annulated seta having length slightly greater than basal width of segment, located dorsally near outer margin just before base of segment, seven normal setae; tarsus surmounted by a slender pretarsus, as long as basal width of tarsus and bearing at its apex a small, curved claw and small empodium. Leg II with coxa subquadrangular, one and one-third times as broad as long, without vestiture; femur subequal in size to femur I, with four setae; genu broader than long, with four setae; tibia as long as genu, slightly longer than broad at base, with four setae; tarsus slightly less than twice as long as tibia, width at base slightly less than one half length of segment, with one clavate, annulated seta with length equal to basal width of segment, located dorsally near outer margin at base of segment, three normal setae; tarsus surmounted by a slender, moderately long pretarsus bearing at its apex a pair of small, curved, spreading claws between and beyond which projects a small empodium. Leg III with coxa broad, elongate, one half as broad as long, without vestiture; femur three fifths as long as coxa about one-half as broad as long, with one seta; genu as broad as long, one half as long as femur, with three setae; tibia slightly longer than genu, with four setae; tarsus one and one-half times as long as tibia, four times as long as broad at base, tapering from base to narrowly rounded apex, with two setae; tarsus surmounted by a short, narrow pretarsus which bears at its apex two small, curved, spreading claws between and beyond which projects a small, broad empodium. Leg IV with coxa subquadrangular, two thirds as long as broad, with one seta; femur moderately long and broad, length slightly greater than twice width of coxa, about twice as long as greatest breadth, widest at basal two fifths, segment narrowing abruptly by a curving inward of inner margin at almost a right angle just before apex curving again to form a right angle and continuing to apex of segment, width of segment at apex equal to one half width at base, with one dorsal seta having length equal to three fifths greatest width of segment, located near outer margin slightly less than one-half length of seta from apex of seg-

ment, one ventral seta two thirds as long as dorsal seta, situated near inner margin at basal two fifths, one ventral seta nearly one and one-half times as long as dorsal seta, situated one half length of seta from apex of segment, one third length of seta from inner margin; tibia about one third as long as femur, one half as broad as long, outer margin convex and nearly twice as long as concave inner margin, segment with one clavate, annulated seta slightly shorter than width of segment, situated dorsally near outer margin at apical fifth, one stout, tactile seta as long as combined lengths of femur and tibia, situated ventrally at apical third; tarsus short, collarlike, with two short dorsal setae and one short ventral seta; tarsus supports a strong, curved claw about as long as tibia. *Genital papilla*: Subcordate with anterior margin rounded and having a conspicuous acuminate emargination, posterior margin rounded truncate; length including projecting appendages, 26μ ; greatest width, measured at mid-length, 26μ . *Measurements*: Length from tips of palpi to posterior extremity of genital papilla, 132μ ; main body suture to apex of genital papilla, 64μ ; anterior margin of propodosomal hood to main body suture, 47μ ; width of body at main body suture, 77μ ; greatest width of body, measured at anterior condyles of coxae III, 87μ .

Female: Due to considerable confusion relating to the association of the sexes of this species, as explained below, it seems ill advised at this time to offer a redescription of the female.

Types: Belle, Maryland, Oct. 16, 1933, F. F. Smith, on strawberry. The type slide, U.S.N.M. number 1130, contains four males definitely identified as *T. laminifer* and six females. One of the male specimens has been encircled by the present writer and this specimen is hereby designated lectotype. Due to the poor orientation and position of these six females on the type slide, positive identification could not be made. However, it appears that one specimen is *X. viridis* and one specimen *T. randsi*. The others are unidentifiable to any of the species described for the first time or redescribed in this paper. It is possible, if not probable, that these remaining four specimens are the females of *T. laminifer*, but in the light of the fact that a second slide bearing identical data was found to include one male and four females of *T. viridis*, one male of what this writer believes to be *T. unguis* and one male of *T. laminifer* it seems advisable to reserve association of females with *T. laminifer* and *T. unguis* until such a time as this can be accomplished on substantial grounds.

Location of types: U. S. National Museum, slide number 1130.

The description of the male given above was made from a specimen remounted from a slide bearing data identical to that on the type slide. The figure of the whole male (Plate 10) was likewise drawn from this specimen. However, the male hind leg (Plate 19) was drawn from one of the type males which had this appendage displayed to good advantage. Measurements of this particular type male specimen are as follows: Tips of palpi to apex of genital papilla, 153 μ ; tips of palpi to main body suture, 78 μ ; width of body slightly behind main body suture, 100 μ ; capitulum 30 μ long and 30 μ wide; genital papilla 26 μ long and 28 μ wide.

The male of this species appears to resemble *T. sulcatus* and *T. occidentalis* more closely than other members of the Setifer Group. It may be readily distinguished from *T. sulcatus* in that the latter species does not have the second pair of ventral hysterosomal setae situated on apodemes IV as well as by distinct differences in the shape of the hind legs. It differs from *T. occidentalis* in having the second dorsal hysterosomal setae quite long, these being as short as the setae of the first pair in *T. occidentalis*, and besides differences in the shape of legs IV, the dorsal femoral seta is longer than the ventral setae in *T. occidentalis* whereas it is shorter than the ventral setae in *T. laminiifer*.

Tarsonemus confusus Ewing

(Plates 13, 20 and 24)

Tarsonemus confusus Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 26.

Tarsonemus assimilis Banks, 1914, Jour. Ent. and Zool., vol. 6, no. 2, p. 60; Rutherford, 1913, Trop. Agr. Peradeniya, vol. 41, no. 6, p. 490 (*T. assimilis* Banks, MS). (new synonymy.)

Male: Body short, oval, broadest at anterior condyles of coxae III; legs moderately long and robust, anterior pairs subequal in size; apodemes distinct and well defined; genital papilla large and conspicuous, larger than capitulum; anal plate large and distinct. Apodemes I as long as genu I, extending in posteromedial directions from innermost angles of coxae I and converging at anterior extremity of median apodeme to form a Y-shaped juncture with the latter. Apodemes II about twice as long as apodemes I and subparallel to the latter, extending from innermost angles of coxae II to juncture with median apodeme at point the length of apodeme II from anterior extremity of median apodeme. Transverse apodeme strong, transecting body in a smooth, uninterrupted arc just anterior to main body suture, the lateral extremities of apodeme being the

length of genu I from lateral margins of body. Anterior median apodeme strong and distinct from point of juncture of apodemes I to point of intersection of apodemes II, less distinct posterior to the latter. Apodemes III extending in anteromedial directions from anterior condyles of coxae III curving gently inward at anterior thirds to join apodemes IV at points the length of femur I behind main body suture. Apodemes IV subparallel to apodemes III for most of their lengths, extending from outer basal angles of coxae IV to juncture with apodemes III, here curving inward to converge at anterior extremity of median apodeme. Posterior median apodeme with anterior extremity at point of convergence of apodemes III, this being the length of femur I behind main body suture, extending posteriorly to point in transverse alignment with anterior extremities of coxae IV, here bifurcating with arms of apodeme diverging and continuing to inner basal angles of coxae IV. A distinct hysterosomal suture transects body dorsally in region of anterior fifth of genital papilla. Dorsum of propodosoma narrowing anteriorly and projected forward to form a cephalothoracic hood which covers basal fifth of capitulum, anterior margin of hood with dimension slightly less than greatest width of capitulum, equal to combined lengths of genu and tibia I. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae slightly longer than combined lengths of tibia and tarsus I, situated one third length of seta behind anterior margin of hood and separated from each other by this distance; second pair of setae three fourths as long as setae of first pair, length about equal to the dimension of truncated anterior margin of hood, situated nearly the length of seta behind and slightly laterad from setae of first pair; third pair of setae nearly three times as long as setae of first pair, situated behind and slightly laterad from second setae a distance equal to three fourths the distance separating first and second setae; fourth pair of dorsal propodosomal setae slightly longer than setae of second pair, located one third length of seta laterad from third setae. First pair of dorsal hysterosomal setae as long as first propodosomals, situated near lateral margins of body three fourths length of seta from main body suture; second pair of setae as long as setae of first pair; third pair of setae three fourths as long as first pair; fourth pair of setae slightly shorter than setae of third pair and located near lateral margins of genital papilla at mid-length of papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as genu I, situated one half length of seta laterad from juncture of apodemes I; second pair of setae as long as first setae, located two thirds length

of seta posterior to apodemes II at mid-lengths of these apodemes. First pair of ventral hysterosomal setae about twice as long as first ventral propodosomals, situated immediately posterior to arclike anterior extremities of apodemes III; second ventral hysterosomals as long as setae of first pair, located on apodemes IV at posterior thirds of these apodemes. *Capitulum*: Small, subcordate with posterior margin rounded truncate and with a slight mesal emargination; length, including projecting palpi, 20μ ; greatest width, measured at posterior third of capitulum, 16μ . Dorsal setae with length equal to one fourth width of capitulum, situated near anterolateral extremities of capsule. Ventral setae slightly shorter than dorsal setae, located near bases of palpi and separated from each other by a distance equal to length of seta. Palpi short and stout, projecting slightly beyond apex of capitulum, indistinctly segmented and ornamented. Chelicerae short and styliform, projecting between but not beyond palpi; cheliceral sheaths without striae. *Legs*: Leg I with coxa subquadrangular, two thirds as long as broad, without vestiture; femur three fourths as broad as long, with three setae; genu about as broad as long, with four setae; tibia one and one-third times as long as broad, with one small, clavate, annulated seta with length equal to two-thirds basal width of segment, situated middorsally one half length of seta from base of segment, one rodlike seta slightly longer than clavate seta, located dorsally near outer margin one half length of seta from base of segment, one capitate seta as long as clavate seta, situated between the latter and the rodlike seta, four normal setae; tarsus one and one-third times as long as tibia, tapering from base to narrowly rounded apex, with one clavate seta with length equal to basal width of segment, located middorsally one half length of seta from base of segment, seven normal setae; tarsus surmounted by a short, slender pretarsus which subtends a small, curved claw and a small empodium. Leg II with coxa subquadrangular, broader than long, without vestiture; femur relatively slender, nearly twice as long as broad, about one-half as long as femur, with three setae; tibia slightly longer than broad, with four setae; tarsus one and one-half times as long as tibia, tapering from base to narrowly rounded apex, with one large, clavate, annulated seta slightly longer than basal width of segment, situated dorsally near outer margin one third length of seta from base of segment, one short, spinelike seta with length equal to one half basal width of segment, located dorsally near outer margin at base of segment, four normal setae; tarsus surmounted by a short, slender pretarsus bearing at its apex two large, curved, spreading

claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa broad and long, more than twice as long as broad, without vestiture; femur three fifths as long as coxa with basal third of segment bulbous and separated from apical portion by a distinct constriction and a partial suture, the telofemur expanding slightly from base toward apex and with one seta; genu slightly longer than broad, one-half as long as femur, with three setae; tibia about one and one-half times as long as genu, with four setae; tarsus as long as tibia, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a short, slender pretarsus which subtends two large, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa subquadrangular, three fourths as long as broad, with one ventral seta as long as segment; femur about twice as long as coxa, as long as combined lengths of genu, tibia and tarsus I, width at base equal to one half length and twice width at apex, outer margin of segment slightly convex for most of its length, inner margin slightly concave from apex to basal fifth and bent sharply inward at this latter point presenting a distinctly angulate appearance, segment with one dorsal seta four fifths as long as segment, situated near outer margin the distal width of segment before apex, one ventral seta about three fourths as long as dorsal seta, situated near inner margin slightly more than distal width of segment before apex, one ventral seta one half as long as the former ventral seta, located on inner margin slightly proximad from mid-segment; tibia short, nearly as broad as long, with one dorsal, rodlike seta one half as long as segment, located near outer margin at mid-segment, one tactile seta slightly longer than femur, situated dorsally near outer margin at apex; tarsus short, collarlike, one and one-half times as broad as long, with two short dorsal setae and one short ventral seta; tarsus subtends a short, pointed claw which is nearly as broad at base as long, its length slightly less than two thirds length of tibia. *Genital papilla*: Large, subcordate, with anterior margin deeply emarginate medially, posterior margin rounded truncate; length, including projecting appendages, 24μ ; greatest width, measured at anterior fifth, 22μ . *Anal plate*: Large and well-defined, longitudinal dimension of central disc equal to length of claw IV, triradiate apodemes strong and each as long as tibia IV. *Measurements*: Length of body from tips of palpi to apex of genital papilla, 143μ ; anterior margin of cephalothoracic hood to apex of genital papilla, 124μ ; anterior margin of hood to main body suture, 40μ ;

width of body at main body suture, 65μ ; width of body at anterior condyles of coxae III, 69μ .

Female: Body broadly oval, broadest at mid-length. Legs of moderate length and robustness; legs II shorter but equally as robust as legs I; legs IV with coxae separated by a distance equal to length of coxa IV and terminal segment of leg IV not reaching to margin of body. Apodemes relatively conspicuous though their limitations are indistinct. Apodemes I strong and distinct for their entire lengths, as long as tibia II, extending in posteromedial directions from innermost angles of coxae I, converging medially to form a Y-shaped juncture with median apodeme. Apodemes II about one and one-half times as long as apodemes I and subparallel to the latter, extending from innermost angles of coxae II to points the basal width of tibiotarsus I laterad from median apodeme. Transverse apodeme strong and distinct for its entire length, transecting body immediately anterior to main body suture, its lateral extremities curved slightly forward shortly before their terminations, the latter being the basal width of genu II from lateral margins of body, the apodeme having two distinctive notches near mid-length. Anterior median apodeme extending from point of juncture of apodemes I to point in transverse alignment with mesal extremities of apodemes II, continuing caudad from here obscurely for a short distance. Apodemes III short, length equal to length of genu I, extending in nearly mesal directions from anterior condyles of coxae III and expanding to fan-shaped apices. Apodemes IV relatively indistinct and interrupted for most of their lengths, extending in anteromedial directions from points the basal width of tibiotarsus I mesad from inner margins of coxae III at posterior thirds of these segments, the apodemes converging to join median apodeme at a point nearly in transverse alignment with anterior extremities of coxae III. Posterior median apodeme extending from point midway between inner apical angles of coxae IV to a point slightly less than the basal width of tibiotarsus I beyond juncture of apodemes III, its anterior extremity bifurcate with each fork very short and projected in an anterolateral direction, posterior third of apodeme and portion anterior to juncture of apodemes III much weaker than remainder of apodeme. Three distinct sutures transect hysterosoma dorsally, the first in region of coxae IV, the remaining two on opisthosoma. Dorsum of propodosoma projected forward to form a broadly rounded cephalothoracic hood which covers basal half of capitulum. Pseudostigmatic organs with ex-

panded apices broadly ovate and equal in length to the slender pedicels. Stigmatal openings conspicuous, their diameters equal to one third the greatest width of apical expansions of pseudo-stigmatic organs, situated dorsolaterally on propodosoma just posterior to lateral indentations marking posterior limits of hood; tracheal pouches conspicuous, oblong in shape, single-lobed, situated in region of juncture of apodemes I. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae slightly longer than capitulum, situated near lateral margins of hood one third the distance from stigmatal openings to apex of hood, setae separated from each other by a distance equal to three fourths length of seta; second dorsal propodosomals very long, about two and one-half times as long as setae of first pair, located slightly more than one half the distance from stigmatal openings to main body suture and about this distance from lateral margins of body. First and second pairs of dorsal hysterosomal setae about two thirds as long as first propodosomals; third, fourth and sixth pairs of setae about one half as long as first pair; fifth pair one and one-half times as long as third pair. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to length of tibia II, situated one third length of seta behind apodemes I at their mid-lengths; second ventral propodosomals as long as first pair, located on apodemes II at their mid-lengths. First pair of ventral hysterosomal setae with length equal to first propodosomals, situated just mesad from broad inner extremities of apodemes III; second ventral hysterosomals with length equal to setae of first pair, located at posterior extremities of apodemes IV; third pair of setae short, situated at apex of hysterosomal and separated from each other by their combined lengths. *Capitulum*: Relatively small and subcordate, with posterior margin slightly emarginate; length, including projecting palpi, 30μ ; greatest width, measured at posterior fourth of capsule, 26μ . Dorsal setae with length equal to two fifths width of capitulum, situated near anterolateral margins of capsule and separated from each other by a distance equal to length of seta. Ventral setae slightly shorter than dorsal setae, located near bases of palpi and separated from each other by a distance equal to length of seta. Palpi relatively short and stout, indistinctly segmented and ornamented. Styliiform chelicerae short, extending between and slightly beyond apices of palpi; cheliceral sheaths without transverse striae. *Legs*: Leg I with coxa subquadrangular, slightly broader than long, without vestiture; femur one and one-half times as long as broad, with one long, tactile seta one and one-half times as long as broad, situated ven-

trally near inner margin at base of segment, two normal setae; genu two thirds as long as femur, about one and one-half times as long as broad, with four setae; tibiotarsus slightly longer than femur, about three times as long as broad at base, tapering slightly from base toward broadly rounded apex, with one small, clavate, annulated seta with length slightly less than one half basal width of segment, located ventrally near outer margin at base of segment, one spinelike seta slightly longer than clavate seta, situated ventrally near outer margin one and two-thirds times length of seta from base of segment, one large, clavate, annulated seta with length slightly greater than basal width of segment, situated dorsally on outer margin at basal two fifths, one small, ventral spur on inner apical margin, one very long tactile seta, ten normal setae; tibiotarsus subtends a short pretarsus which bears at its apex a strong, curved claw and a large empodium. Leg II with coxa subquadrangular, slightly broader than long, without vestiture; femur robust, slightly longer than broad, with one stout, lanceolate seta one half as long as segment, situated dorsally near inner margin at apical fifth, two normal setae; genu one half as long as femur, as broad at base as long, with one stout, spinelike seta as long as segment, situated middorsally at base of segment, two normal setae; tibia as long as genu, slightly longer than broad, with four long setae; tarsus one and one-half times as long as tibia, tapering from its broad base to mid-segment with sides subparallel from this point to broadly rounded apex, with one stout, spinelike seta having length equal to one half basal width of segment, situated on outer margin of segment at base, one clavate, annulated seta slightly longer than spinelike seta, located dorsally on outer margin immediately distad to spinelike seta, one spurlike projection with dimensions subequal to spinelike seta, situated ventrally near inner margin at apex, four normal setae; tarsus surmounted by a short, slender pretarsus which subtends two large, curved, spreading claws between and beyond which projects a large, bilobed empodium. Leg III with coxa slender, elongate, about four times as long as broad, length equal to combined lengths of femur, genu and tibia II, without vestiture; femur one half as long as coxa, basal two fifths of segment bulbous and separated from remainder of segment by a distinct constriction and a partial suture, with the telofemur expanding from constriction to apex and bearing four setae; tibia as long as femur, tapering slightly from base to apex, with four setae; tarsus slender, elongate, about five times as long as broad with lateral margins subparallel, segment with three setae; tarsus surmounted by a short, slender,

pretarsus with imbricated lateral margins and subtending two large, curved, spreading claws between and beyond which projects a large empodium. Leg IV with coxa subtriangular, as broad at apex as long, without vestiture; trochanter small, collarlike, twice as broad as long, without setae; third segment very slender and elongate, slightly dilated at base and apex, about seven times as long as broad at mid-length, with one ventral seta two fifths as long as segment situated on inner margin near base, one ventral seta one fourth as long as segment located near outer margin at apical fourth; fourth segment one fourth as long as third segment, with one stout, ventral seta four times as long as segment, located at mid-segment, terminal seta about as long as leg IV. *Measurements*: Length of body from tips of palpi to apex of hysterosoma, 186 μ ; anterior extremity of cephalothoracic hood to apex of hysterosoma, 172 μ ; anterior extremity of hood to main body suture, 54 μ ; width of body at main body suture, 91 μ ; width of body at anterior condyles of coxae III, 111 μ ; distance between innermost extremities of coxae IV, 10 μ .

Types: Suitland, Maryland, Sept. 20, 1933, F. F. Smith (two males and two females mounted on a single slide). One of the male specimens has been encircled by the present writer and this specimen is hereby designated lectotype.

Location of types: U. S. National Museum (slide number 1124).

Material studied by the present writer in addition to the type series included specimens identified by the following data: Berkeley, Calif., Mar. 10, 1951, Carl H. Spitzer, in culture of *Fusarium oxysporium* var. *dianthi*; Fort Valley, Ga., July 14, 1949, Max R. Osburn, on pecan; Red Lion, N. J., Mar. 14, 1950, John P. Reed, corn husk; Salem, N. J., Aug. 15, 1949, John P. Reed, on tomato leaves; Flushing, L. I., N. Y., July 12, 1936, K. W. Cooper, from *Sporotrichium* cultures rearing *Pediculopsis*; Arlington Farm, Va., Aug. 12, 1937, Evinger and Grant, on black locust leaf; Prosser, Wash., Aug. 14, 1951, D. R. Malcom, on red clover.

The above description of the male was made from one of the Arlington Farm specimens and of the female from one of the Berkeley specimens.

The male of this species very closely resembles the male of *T. scaurus* but may be readily distinguished by the short claws on leg IV, these being long in *T. scaurus* and by the position of the second ventral hysterosomal setae, which, in *T. scaurus* are on apodemes II whereas in *T. confusus* they are some distance behind these apodemes. Both of these species have the inner margins of

femora IV distinctly angulate near base of segment. The male of *T. simplex* is similar to *T. confusus* in most respects but lacks the angulate character of femora IV. Females of this species are most easily identified by the two distinct notches on the transverse apodeme. Many of the mites identified as *T. confusus* by Ewing (1939) were found by the present writer to be *T. scaurus* or some other species.

Tarsonemus waitei Banks

(Plates 13, 20 and 24)

Tarsonemus waitei Banks, 1904, Proc. Ent. Soc. Washington, vol. 14, no. 2, p. 96; Quaintance, 1912, U. S. Dept. Agr. Bur. Ent. and Plant Quarantine Bull., 97, pt. 6, p. 103; Rutherford, 1913, Trop. Agr. Peradeniya, vol. 41, no. 6, p. 490; Weiss, 1915, Ent. News, vol. 26, no. 4, p. 149; Ewing, 1915, U. S. Dept. Agr. Rept., 108, p. 104; Mozzette, 1917, Jour. Agr. Res., vol. 10, no. 8, p. 373; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 22.

Male: Body short and broadly oval, broadest at mid-length; legs short and stout, anterior pairs subequal in size; genital papilla larger than capitulum; anal plate large and rather conspicuous. Apodemes strong and clearly defined, those of legs I as long as genu I, extending in posteromedial directions from inner basal angles of coxae I, converging mesially to form a Y-shaped juncture with median apodeme. Apodemes II about twice as long as apodemes I and subparallel to the latter, extending from innermost angles of coxae II to juncture with median apodeme. Transverse apodeme moderately strong and distinct, transecting body just anterior to main body suture, its lateral extremities not reaching margins of body but curved forward toward posterior basal angles of coxae II and terminating just before reaching coxae. Apodemes III strong and conspicuous for their entire lengths, extending in antero-medial directions from anterior condyles of coxae III for a distance nearly equal to length of coxa III, then curving abruptly inward to intersect apodemes IV midway between point of incurving and median apodeme. Apodemes IV subparallel to apodemes III, extending from outer basal angles of coxae IV to point of intersection with apodemes III, this being the length of tibia I behind main body suture, here curving abruptly inward to intersect median apodeme at the anterior extremity of the latter. Posterior median apodeme extending from point of juncture of apodemes IV to inner basal angles of coxae IV, bifurcate at posterior fourth of its length. One conspicuous hysterosomal suture present, transecting body at about anterior two fifths of genital papilla. Dorsum of propodosoma with anterior margin broadly truncated and projecting over basal third of capitulum. *Dorsal chaetotaxy:* First pair of dorsal propodosomal

setae with length equal to combined lengths of genu and tibia I, slightly shorter than width of anterior margin of propodosomal shield, situated two fifths length of seta behind anterior margin of shield and separated from each other by a distance equal to three fourths length of seta; second dorsal propodosomals one half as long as setae of first pair, situated posterior to and slightly laterad from the latter a distance equal to length of second seta; third pair of setae relatively short, length about one and one-third times the length of first setae, located in linear alignment with first and second setae two thirds the distance separating first and second setae behind the latter; fourth pair of dorsal propodosomal setae with size subequal to setae of third pair, situated laterad from setae of third pair a distance equal to that separating second and third setae. First pair of dorsal hysterosomal setae with size about equal to size of first propodosomals, situated near lateral margins of body two thirds length of seta behind main body suture; second dorsal hysterosomals slightly shorter than setae of first pair; third and fourth pairs of setae subequal in size, slightly shorter than second pair, the fourth pair situated at lateral margins of genital papilla just posterior to mid-length of papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to length of genu I, situated one half length of seta laterad from juncture of apodemes I; second pair of setae with size subequal to first setae, situated one half length of seta behind apodemes II at mid-lengths of apodemes. First pair of ventral hysterosomal setae as long as first propodosomals situated just behind apodemes III and slightly mesad from the curves of their anterior extremities; second pair of setae with size subequal to first setae, located on apodemes IV at posterior thirds of apodemes. *Capitulum*: Subcordate with posterior margin rounded and slightly emarginate; length, including projecting palpi, 26 μ ; greatest width, measured at basal third, 19 μ . Dorsal setae with length equal to length of genu I, situated near lateral margins one half length of seta behind apex of capsule. Ventral setae with length subequal to that of dorsal setae, located near bases of palpi and separated from each other by a distance equal to length of seta. Palpi moderately long and robust, projecting a short distance beyond apex of capsule, indistinctly segmented and ornamented. Chelicerae styloform, projecting between but not beyond palpi; cheliceral sheaths without transverse striae. *Legs*: Anterior pairs relatively long and robust, slightly longer than propodosoma. Leg I with coxa subquadrangular, about one and one-half times as broad as long, without vestiture; femur stout, having length equal

to width of coxa, with four setae; genu one half as long as femur, about as broad as long, with four setae; tibia slightly longer than genu, with one short, clavate, annulated seta having length equal to one third basal width of segment, situated dorsally near inner margin the length of seta from base of segment, one capitate seta nearly twice as long as clavate seta, situated immediately mesad from the latter, one rodlike seta slightly longer than clavate seta, situated immediately beside the latter, four normal setae; tarsus one and one-fourth times as long as tibia, tapering from base toward apex, with one small, clavate, annulated seta having length equal to one half basal width of segment, situated dorsally near outer margin one half length of seta from base of segment, seven normal setae; tarsus surmounted by a short, slender pretarsus bearing at its apex a small, curved claw and a small empodium. Leg II with coxa subquadrangular, twice as broad as long, without vestiture; femur short and stout, nearly as broad as long, with three setae; genu about one half as long as femur, slightly broader than long, with three setae; tibia slightly shorter than genu and slightly broader than long, with four setae; tarsus broad at base but tapering abruptly and being slender for most of its length, slightly longer than combined lengths of genu and tibia II, with one very large, broad, clavate, annulated seta having length slightly greater than basal width of segment and width equal to one half its length, situated dorsally near outer margin at base of segment, three normal setae; tarsus surmounted by a slender pretarsus bearing at its apex two small, curved, spreading claws between and beyond which projects a small, bilobed empodium. Leg III with coxa robust, about twice as long as broad, without vestiture; femur slightly more than one half as long as coxa, with one seta; genu one half as long as femur, slightly longer than broad, with three setae; tibia one and one-third times as long as genu, with four setae; tarsus as long as tibia, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a slender pretarsus with imbricated margins, bearing at its apex two small, curved, spreading claws between and beyond which projects a small, bilobed empodium. Leg IV with coxa subquadrangular, robust, about twice as broad as long, with one ventral seta as long as segment; femur short and stout, one and one-third times as long as broad at base, inner and outer margins convex, one dorsal seta with length equal to basal width of segment, situated on a large tubercle near outer margin at about mid-segment, one ventral seta slightly shorter than dorsal seta, situated on a large tubercle near inner margin three fourths length of seta from

apex of segment, one small ventral seta one half as long as the other ventral seta, situated on inner margin at about basal third of segment; tibia short and stout, nearly as broad as long, with one rod-like seta having length equal to one half basal width of segment, situated dorsally near outer margin at apical third, one short, stout, tactile seta, nearly as long as femur, situated near outer margin at apical fourth of segment; tarsus short, collarlike, one and one-half times as broad as long, with two short dorsal setae and one short ventral seta; tarsus subtends a large, curved, pointed claw having length equal to combined lengths of tibia and tarsus. *Genital papilla*: Large, subcordate, with anterior margin rounded and deeply emarginate mesially, posterior margin truncate; length, including projecting appendages, 25μ ; greatest width, measured at anterior third, 23μ . *Anal plate*: Large and conspicuous; central disc with greatest dimension equal to the basal width of tarsus III, triradiate apodemes subequal in length, each as long as genu III. *Measurements*: Tips of palpi to apex of genital papilla, 139μ ; anterior margin of propodosomal hood to apex of genital papilla, 117μ ; anterior margin of hood to main body suture, 48μ ; width of body immediately posterior to main body suture, 78μ .

Female: Body short and broadly oval, broadest at mid-length. Legs moderately short and stout, the second pair as long as but stouter than first pair; fourth pair very short, with their coxae well separated from each other and apices of fourth segments well separated from margins of body. Apodemes moderately strong, those of legs I two thirds as long as genu I, extending in postero-medial directions from innermost angles of coxae I converging medially. Apodemes II two thirds as long as tibiotarsus I, subparallel to apodemes I, extending from innermost condyles of coxae II to points the basal width of tibiotarsus I from median apodeme, their mesal terminations abrupt. Transverse apodeme strong and distinct, transecting body in a smooth, unbroken arc a short distance in front of main body suture, its lateral extremities the length of tibia II from margins of body. Anterior median apodeme extending forward from transverse apodeme for two thirds the distance from transverse apodeme to juncture of apodemes I, terminating abruptly at this point, posterior half of median apodeme not as distinct as anterior half of its length. Apodemes III short and broad, extending in nearly transverse directions from anterior condyles of coxae III for a distance equal to the length of femur III, their mesal extremities broad and fan-shaped. Apodemes IV short and weak, ex-

tending in anteromedial directions from points in transverse alignment with posterior thirds of coxae III, one half width of coxa III from their mesal margins, nearly to juncture with median apodeme but terminating indistinctly before such juncture. Posterior median apodeme extending from point in transverse alignment with anterior extremities of coxae IV to point the width of tarsus III behind main body suture, bifurcating at this anterior extremity with each arm extending for a short distance in an anterolateral direction, the apodeme strong and distinct only for the short part of its length situated between apodemes III. One obscure hysterosomal suture transects body dorsally at a point two fifths the distance from main body suture to apex of hysterosoma, this being in line with anterior thirds of coxae III. Three distinct sutures transect opisthosoma. Dorsum of propodosoma projected to form a broadly-rounded cephalothoracic hood which overhangs basal third of capitulum, the hood separated from remainder of dorsal propodosomal plate by a weak suture. Pseudostigmatic organs with their elongate, oval, expanded apices having a width equal to the length of slender pedicels. Stigmatal openings small, subcircular, situated dorsolaterally on propodosoma immediately posterior to suture forming posterior delimitation of cephalothoracic hood. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae quite long, length about equal to length of capitulum, situated posterolaterally on cephalothoracic hood; second pair of setae one and one-half times as long as first setae, located one third length of seta from main body suture, this distance from lateral margins of body. First pair of dorsal hysterosomal setae three fourths as long as first propodosomals, situated on lateral margins of body two thirds length of seta behind main body suture; setae of second pair equal in size to first setae; setae of third, fourth, fifth and sixth pairs short and subequal in length, two fifths as long as second setae. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to basal width of tibiotarsus I, situated slightly behind apodemes I at mid-lengths of apodemes; second ventral propodosomals slightly longer than setae of first pair, located on apodemes II at their mid-lengths. First pair of ventral hysterosomal setae with length subequal to second ventral propodosomals, situated immediately mesad to mesal extremities of apodemes III; second ventral hysterosomal setae as long as setae of first pair, located at posterior extremities of apodemes IV; third pair of setae short, situated near apex of opisthosoma. *Capitulum*: Small, slender,

subcordate with posterior margin rounded truncate and having a slight mesal emargination. Length, including projecting palpi, 29μ ; greatest width, measured at posterior sixth of capsule, 22μ . Dorsal setae with length equal to one third width of capitulum and situated near anterolateral margins of capsule, separated from each other by a distance equal to length of seta. Ventral setae as long as dorsal setae, located near bases of palpi and separated from each other by a distance equal to two thirds length of seta. Palpi short and moderately robust, projecting a short distance beyond capitulum, indistinctly segmented and ornamented. Styliform chelicerae projecting between and slightly beyond apices of palpi; cheliceral sheaths without transverse striations. *Legs:* Leg I with coxa subquadrangular, as broad as long, without vestiture; femur one and one third times as long as broad, with two small dorsal setae, two long ventral setae; genu as broad at base as long, tapering slightly toward apex, with four setae; tibiotarsus twice as long as genu, about one third as broad at base as long, tapering slightly to broadly rounded apex, with one clavate, annulated seta having length equal to one half basal width of segment, situated middorsally on segment one half length of seta from base, one capitate, sensory seta as long as clavate seta, situated dorsally between clavate seta and outer margin of segment, one dorsal, spinelike seta slightly longer than capitate seta, located on lateral margin beside capitate seta, one large, clavate, annulated seta with length equal to three fourths basal width of segment, located dorsally near inner margin at about mid-segment, one short, ventral, spurlike process projecting forward from inner apical margin of segment, eleven normal setae; tarsus surmounted by a short, broad pretarsus bearing at its apex a stout, curved claw and a small empodium. Leg II with coxa subquadrangular, slightly broader than long, without vestiture; femur short and stout, as broad at base as long, with three setae; genu broader than long, with three setae; tibia short and stout, as broad as long, with four setae; tarsus as long as tibia, as broad at base as long, tapering from base to narrowly rounded apex, with one clavate, annulated seta having length equal to one half basal width of segment, located dorsally on inner margin one half length of seta from base of segment, one very stout, spinelike seta with length equal to basal width of segment, located dorsally near inner margin at base, one stout spur having length equal to one half basal width of segment located ventrally near outer apical margin, four normal setae; tarsus surmounted by a very short, broad pretarsus subtending two strong, curved claws and a broad empodium. Leg

III with coxa slender, elongate, as long as combined lengths of genu, tibiotarsus and pretarsus I, one fourth as broad as long, without vestiture; femur two fifths as long as coxa, the basal two fifths of segment bulbous and separated from remainder of segment by an incomplete suture, the telofemur expanding from its base toward the broad apex and bearing two setae; tibia long and broad with its lateral margins slightly convex, length of segment equal to length of femur, with one very long ventral seta at basal third, one moderately long and two short setae at apical third of segment; tarsus slender, elongate, slightly shorter than tibia, with one short, stout spur situated ventrally near outer, apical margin, three normal setae; tarsus surmounted by a short, broad pretarsus with lateral margins appearing imbricated and bearing at its apex two large, curved, spreading claws between and beyond which projects a broad empodium. Leg IV with coxa subtriangular, as broad as long, without vestiture; trochanter small, collarlike, broader than long, without setae; third segment relatively short, one and one eighth times as long as tibia II, with one ventral seta one half as long as segment situated near outer margin just before base of segment, one seta three fourths as long as segment, situated ventrally near outer margin just before apex; fourth segment about one third as long as third segment, with one stout ventral seta one and one half times as long as third segment, situated near mid-segment, one terminal seta twice as long as combined lengths of third and fourth segments. *Measurements*: Length of body from tips of palpi to apex of hysterostoma, 191 μ ; anterior margin of cephalothoracic hood to apex of hysterostoma, 122 μ ; anterior margin of hood to main body suture, 49 μ ; width of body at anterior condyles of coxae III, 102 μ ; distance between anterior condyles of coxae III, 52 μ ; distance between innermost margins of coxae IV, 10 μ .

Types: Hoopes Bros. and Thomas Nursery, West Chester, Penn. Aug. 24-25, 1911, J. F. Zimmer, peach buds.

Location of types: U. S. National Museum (slide number 1122).

Material studied by the present writer included the type series as well as specimens identified by the following data: Bot. Dept., Mich. Agr. Coll., infesting fungus cultures (one male, several females); Avoncino-Mortensen Nursery, Colma, Calif., Nov. 15, 1949, R. E. Beer, fungus on agar plate culture of orchid seedlings (one male); Rockaway Beach, San Mateo Co., Calif., Dec. 13, 1949, R. E. Beer, mushroom house (one male, twenty females).

The above description of the male was made from the Colma, Calif. specimen; the description of the female given above was made

from one of the Rockaway Beach series. The specimens in the original type series, so far as this writer could determine, are mounted on three slides, each slide identified by the same data and bearing the number Q6672. One slide contains a single male specimen, another a single female specimen and the third slide a single female and a badly shattered larva. Although the type series was studied by the present writer in the original balsam mounts, which have the specimens in a rather good state of preservation but poorly oriented on the slide, the composite picture of detailed characteristics of this species was surprisingly easy to derive, with subsequent identification of the Colma and Rockaway Beach series. Examination of the type slide containing the female and larva specimens reveals how Banks in his original characterization of the female of this species was led to mention as the most startling characteristic a series of long spines situated caudolaterally. In the specimen mentioned a slivering of the first opisthosomal segment has occurred which could easily be mistaken for spines. The male specimen in the above cotype series is hereby designated lectotype.

In life, mature adults of this species are pale amber in color, the dorsum of the females being greatly convex. The Rockaway Beach collection was made in a commercial mushroom house where the infestation was so severe that the surface of the casing soil in the benches actually had an amber rather than the natural black color. Under such conditions this species undoubtedly, through its fungivorous habits, is destructive to the crop being grown. As pointed out earlier in this paper, Banks' impression that *T. waitei* was destructive to terminal buds of peach trees was doubtless the incrimination of a guiltless trespasser.

Tarsonemus simplex Ewing

(Plates 13, 20 and 24)

Tarsonemus simplex Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 32.

Male: Body broad, oval, broadest at mid-length; legs of moderate length; apodemes distinct and well defined; genital papilla larger than capitulum; anal plate large and conspicuous. Apodemes I extending in posteromedial directions from inner angles of coxae I, converging medially at point in line with posterior margins of coxae I. Apodemes II twice as long as apodemes I and subparallel to the latter, extending from inner angles of coxae II to posterior extremity of anterior median apodeme. Anterior median apodeme extending from Y-shaped juncture of apodemes I to point slightly more than half distance to main body suture, this being point of convergence

of apodemes II. Transverse apodeme moderately strong and conspicuous, transecting body in a smooth arc just anterior to main body suture. Posterior apodemes conspicuous. Apodemes III one and one-half times as long as coxae III, extending in anteromedial directions from anterior condyles of coxae III, curving inward rather abruptly at anterior third, converging with apodemes IV. Apodemes IV extending from outer basal angles of coxae IV to points the combined lengths of tibia and tarsus I behind main body suture, equidistant from median apodeme and apodemes III for their entire lengths, continuing in anteromedial directions from point of juncture with apodemes III for a distance equal to basal width of tarsus III, curving in posteromedial direction at this point and converging medially at anterior extremity of median apodeme. Posterior median apodeme extending from point of juncture of apodemes IV to point in line with anterior extremities of coxae IV, bifurcate at this point with forks extending to inner basal angles of coxae IV. Hysterosomal suture transecting body dorsally at posterior extremities of coxae III. Cephalothoracic shield with broadly truncate anterior margin longer than width of capitulum, projecting over basal fourth of capitulum. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae; first pair as long as combined lengths of tibia and tarsus I, situated one half length of seta behind anterior margin of cephalothoracic shield, separated from each other by a distance equal to two thirds length of seta; second pair of setae two thirds as long as first pair, located the length of seta behind setae of first pair; third pair of setae one and one-half times as long as setae of first pair, located a distance equal to one third length of seta behind setae of second pair; fourth pair of setae as long as third pair, situated a distance equal to one third length of seta posterolaterad from setae of third pair. Hysterosoma with first pair of setae nearly as long as fourth pair of dorsal propodosomal setae, located one and one-fourth times length of seta behind main body suture, one third length of seta from lateral margins of body; second pair of setae as long as combined lengths of genu and tibia II, located near lateral margins of body, one half length of seta before hysterosomal suture; third pair of setae slightly shorter than second pair, located one half length of seta before hysterosomal suture at lateral margins of genital papilla; fourth pair of setae as long as third pair, located near lateral margins of body at apical third of genital papilla. *Ventral chaetotaxy*: Propodosoma with first pair of setae as long as basal width of tibia I, located one half length of seta postero-laterad from point of juncture of apodemes I; second pair of setae

one and one-half times as long as setae of first pair, located one third length of seta behind apodemes II at their mid-lengths. Hysterosoma with first and second pairs of ventral setae located in interapodemal areas defined by apodemes III and IV; first pair as long as tibia III, located nearly on apodemes III at points the length of seta from juncture of apodemes III and IV; second pair of setae as long as first pair, situated nearly on apodemes IV, about twice length of seta from posterior extremities of apodemes. *Capitulum*: Subcordate, the posterior margin rounded truncate; length including projecting palpi, 28μ ; greatest width, 21μ . Dorsal setae as long as genu I, located at apical fourth of capitulum, separated from each other by a distance equal to one and one-fourth times length of seta. Ventral setae as long as dorsal setae, separated from each other by a distance slightly less than length of seta. Palpi stout, indistinctly segmented, projecting beyond apex of capitulum. Chelicerae short, needlelike; cheliceral sheaths prominent, without transverse or spiral striae. *Legs*: Anterior pairs of moderate length, slightly longer than propodosoma, legs I slightly longer than legs II. Leg I with coxa subquadrangular, one and one-half times as broad as long, with width equal to combined lengths of genu and tibia I, without vestiture; femur as long as width of coxa, with two normal setae; genu slightly more than one half as long as femur, slightly broader than long, with four setae; tibia one and one-third times as long as genu, the lateral margins subparallel for most of their lengths, with one clavate, annulated seta having length equal to one third basal width of segment, located near outer margin the length of seta from base of segment, one capitate seta with length equal to one half basal width of segment located on outer margin at basal third, five normal setae; tarsus one and one-fourth times as long as tibia, nearly three times as long as broad at base, tapering slightly to broadly rounded apex, with one clavate, annulated seta as long as basal width of segment located near outer margin at base, five normal setae; tarsus surmounted by a narrow pretarsus with length equal to apical width of tarsus, bearing at its apex a single, stout, curved claw projecting beyond a small empodium. Leg II with coxa subquadrangular, nearly twice as broad as long, without vestiture; femur as long as combined lengths of genu and tibia, outer margin twice as long as inner margin, with one seta; genu one half as long as femur, one and one-half times as broad as long, with three setae; tibia slightly longer than genu, slightly broader than long, lateral margins subparallel, segment with four setae; tarsus as long as combined lengths of genu and tibia, about two and one-half times as long as broad

at base, tapering abruptly to narrowly rounded apex, with one very large, broadly lanceolate, annulated seta having length equal to basal width of segment, one half as broad as long, situated dorsally near inner margin at base, four normal setae; tarsus surmounted by a narrow pretarsus, about one fourth as long as tarsus, bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa as long as combined lengths of genu, tibia, and tarsus of leg II, slightly more than twice as long as broad, with anterior extremity acute, segment without vestiture; femur two thirds as long as coxa, with basal half expanded bulbous, with one dorsal seta; genu as long as tibia II, as broad as long, expanded slightly toward apex, with three normal setae; tibia one and one-half times as long as genu, nearly twice as long as broad at base, with lateral margins parallel for most of their lengths, segment with four normal setae; tarsus as long as tibia, two and one-half times as long as broad at base, tapering to broadly rounded apex, with three setae; tarsus surmounted by a narrow pretarsus, nearly one half as long as tarsus, bearing distally two curved, spreading claws between and beyond which projects a broad empodium. Leg IV with short, subquadrangular coxa nearly twice as broad as long, width equal to combined lengths of tibia and tarsus I, with one ventral seta as long as segment located near outer margin at about mid-segment; femur short and broad, length equal to combined lengths of genu, tibia, and tarsus III, greatest width slightly more than half length of segment, the outer margin uniformly convex, inner margin straight for most of its length but gently incurved at base, segment with one dorsal seta two thirds as long as segment located one third the distance from outer to inner margin at apical third of segment, one ventral seta nearly as long as segment located near inner margin at apical third, one ventral seta one half as long as dorsal seta located near inner margin slightly basad from mid-segment; tibia as long as apical width of femur, with one dorsal, peglike, annulated seta having length equal to basal width of segment, located near outer margin at apical third, one elongate, tactile seta, as long as leg IV, located ventrally near outer margin at apex; tarsus very small, one fourth as long as tibia, three times as broad as long, with one seta as long as width of segment located dorsally on inner margin at mid-segment, one ventral seta as long as width of segment situated on inner margin at mid-segment, one short seta on outer margin at mid-segment; tarsus surmounted by a large, curved claw, nearly as long as combined lengths of tibia and tarsus, with width at base equal to one third its

length. *Genital papilla*: Length, 26μ ; width 24μ ; subcordate, with anterior margin emarginate, posterior margin broadly truncate, bearing two short, caudolateral, projecting horns. *Anal plate*: Large and well-defined, with diameter of central disc equal to one half width of tibia II; triradiate apodemes each as long as tibia I with expanse of plate equal to combined lengths of genu and tibia II. *Measurements*: Length from tip of capitulum to apex of genital papilla, 136μ ; main body suture to apex of genital papilla, 79μ ; anterior margin of cephalothoracic shield to main body suture, 39μ ; width of body at main body suture, 66μ ; width at anterior extremities of coxae III, 76μ .

Female: Body broad, oval, broadest at posterior extremities of coxae III. Legs short and stout, the anterior pairs rather widely separated from posterior pairs; legs III separated from each other at nearest point by a distance equal to distance from posterior extremity of coxa III to lateral margin of body; inner angles of coxae IV separated from each other by a distance equal to three fourths length of third segment of leg IV. Apodemes inconspicuous and not clearly defined, those of legs I converging medially slightly behind anterior extremity of ventral plate. Apodemes II very faint, length equal to twice length of tibia II, extending from inner angles of coxae II in posteromedial direction terminating at point the length of apodeme before main body suture and one half length of apodeme from mid-body. Anterior median apodeme visible as a faint broken line extending from juncture of apodemes I almost to main body suture. Transverse apodeme apparently absent. Posterior apodemes reduced, those of legs III extending in nearly cephalic directions from anterior condyles of coxae III for a distance equal to one fourth greatest width of coxa III, curving abruptly in anteromedial direction at this point and continuing for distance equal to width of coxa III, the posterior fourth of apodemes distinct, remaining portions very faint; apodemes IV indistinct. Posterior median apodeme as long as tibia II. First hysterosomal suture well defined, transecting body the length of tarsus II behind main body suture. Two well-defined transverse sutures on opisthosoma. Dorsum of propodosoma projected to form a cephalothoracic shield which extends over basal half of capitulum, its truncate anterior margin with dimension equal to two thirds greatest breadth of capitulum. Pseudostigmatic organs as long as tibiotarsus I, the expanded apex elongate-oval as long as narrow pedicel and one and one-half times as long as greatest breadth. Stigmatal openings distinct, diameter about equal to one third greatest width of ex-

panded apex of pseudostigmatic organs, located in line with basal fifth of capitulum one fourth width of capitulum laterad from margin of capitulum. *Dorsal chaetotaxy*: Propodosoma with first pair of setae having length equal to two thirds greatest width of capitulum, located near margin two thirds length of seta behind anterolateral angles of propodosoma; second pair with length equal to width of capitulum, situated immediately behind areoli of pseudostigmatic organs. Hysterosoma with first pair of setae as long as tibiotarsus I, located on lateral margins of body one half length of seta behind main body suture; second pair of setae two thirds as long as setae of first pair, located three fourths length of seta in front of and slightly laterad from anterior condyles of coxae III; setae of third pair as long as those of second pair, located twice length of seta behind posterolateral angles of coxae III; fourth pair of setae with length equal to greatest width of femur III, located near lateral margins of body the length of seta in front of last hysterosomal suture; setae of fifth pair subequal in length to setae of fourth pair, located one half length of seta before last hysterosomal suture and separated from each other by a distance equal to twice length of seta; sixth pair of setae slightly longer than setae of fifth pair, situated on lateral margins of apical segment of hysterosoma and separated from each other by a distance equal to twice length of seta. *Ventral chaetotaxy*: Propodosoma with first pair of setae having length equal to width of genu I, located one half length of seta behind anterior margin of ventral plate, separated from each other by a distance equal to one and one-half times length of seta; second pair of setae one and one-half times as long as setae of first pair, situated slightly behind apodemes II at about their mid-lengths. Hysterosoma with first pair of setae having length equal to width of tibia II, situated one third length of seta behind first hysterosomal suture, separated from each other by a distance equal to three and one-half times length of seta; second pair of setae subequal in length to first pair, located the length of seta mesad from inner margins of coxae III slightly posterior to their mid-lengths; third pair of setae slightly shorter than setae of second pair, located at apex of hysterosoma and separated from each other by a distance equal to slightly more than twice length of seta. *Capitulum*: Subcordate, the posterior margin truncate; length including projecting palpi, 33 μ ; width, 27 μ . Dorsal setae short, their length equal to basal width of tibiotarsus I, located in line with bases of palpi and one half length of seta from lateral margins of capitulum, separated from each other by a distance equal to one

and one-half times length of seta. Ventral setae slightly shorter than dorsal setae, located in line with latter. Palpi short and broad, their lengths equal to length of tibia II, width nearly one half length, the palpal bases inserted on apical fifth of capitulum. Chelicerae needlelike, projecting forward as far as palpi; cheliceral sheaths not striate. *Legs*: Anterior pairs short and broad. Leg I with coxa subtriangular, nearly one and one-half times as broad as long, without vestiture; femur with length equal to two thirds greatest width of capitulum, one and one-fourth times as long as greatest breadth, tapering slightly from base to apex, with four normal setae; genu, two thirds as long as femur, slightly longer than broad at base, with four setae; tibiotarsus about twice as long as genu, tapering slightly to broadly rounded apex, with one lanceolate, annulated seta having length equal to two thirds basal width of segment located dorsally on inner margin just before mid-segment, eleven normal setae; tarsus surmounted by a short pretarsus, with length equal to two thirds basal width of tarsus and bearing subapically a stout, curved claw and a small empodium. Leg II with coxa subtriangular, one and one-half times as broad as long, without vestiture; femur as long as femur I, nearly as broad at base as long, tapering slightly to apex, with two setae; genu one half as long as femur, one and one-half times as broad as long, with three setae; tibia slightly longer than genu, as broad as long, outer margin strongly convex, with four setae; tarsus as long as tibia, tapering abruptly from base to narrowly rounded apex, with one clavate seta having length equal to one half width of tibia, located near inner margin at base, three normal setae; tarsus surmounted by a short pretarsus with length equal to one half basal width of tarsus, bearing at its apex two stout, curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa narrow, as long as combined lengths of three distal segments of leg II, nearly four times as long as broad, without vestiture; femur one half as long as coxa, the outer margin indented at about mid-length, with basal half of segment expanded bulbous, lateral margins divergent from mid-length to apex, width at apex equal to two fifths length of segment, bearing two setae; tibia as long as tibiotarsus I, two and one-half times as long as greatest breadth, tapered slightly from mid-length to apex, with four setae; tarsus narrow, elongate, with length equal to three fourths length of tibia, sides subparallel for most of their lengths, with three setae; tarsus surmounted by a short pretarsus with length equal to basal width of tarsus, bearing at its

apex two spreading, curved claws between and beyond which projects a broad empodium. Leg IV with coxa collarlike, more than twice as broad as long, without vestiture, inner margins of coxae separated from each other by a distance slightly less than combined widths of segments; trochanter small, ringlike, broader than long, without setae; third segment rodlike, as long as tibia III, with one ventral seta one fourth as long as segment located on outer margin near base, one ventral seta one third as long as segment located on outer margin at about apical third of segment; fourth segment about two fifths as long as third segment and three times as long as broad at base, expanding slightly toward apex, with one subapical, ventral seta nearly as long as third segment located near outer margin at apical third, one terminal seta nearly one and one-half times as long as leg IV. *Measurements:* Tips of palpi to apex of opisthosoma, 191 μ ; apex of cephalothoracic shield to tip of opisthosoma, 175 μ ; tip of shield to main body suture, 48 μ ; width at main body suture, 72 μ ; width at anterior condyles of coxae III, 92 μ ; distance between anterior condyles of coxae III, 49 μ .

Types: One male and twelve females mounted on one slide, three females on a second slide, both slides identified with the following data: Mass., 1929, Dr. Plakidas, on *Fragaria* sp. The male specimen is hereby designated lectotype.

Location of types: Two slides in U. S. National Museum, numbered 1128.

In addition to the type series, the present author examined specimens which were recognized as this species and which are identified by the following data: Univ. of Wisc., Plant Path. Lab., infesting fungus cultures (one male and three females); U. C. Botany Dept. greenhouse, Berkeley, Calif., Aug. 16, 1949, R. E. Beer, agar culture of fungus (six males and three females); K. U. Ent. Lab., Lawrence, Kans., Apr. 10, 1953, R. E. Beer, from cockroach rearing cage (two males and two females).

The above descriptions of both sexes were made from specimens of the Berkeley series.

This species very closely resembles *T. pritchardi*, *T. confusus* and *T. waitei*. The tactile seta of tibia IV in the male is quite long, which distinguishes this species from both *T. confusus* and *T. waitei*, both of which have relatively short tactile setae. The long claw of the male leg IV further distinguishes this species from *T. confusus* as well as from *T. pritchardi*, both of which have relatively short claws.

Tarsonemus texanus Ewing

(Plates 14, 20 and 24)

Tarsonemus texanus Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 31.

Male: Body broadly oval, broadest at anterior condyles of coxae III; legs relatively short and robust, the anterior pair slightly longer but not as stout as legs II, legs IV short and very stout; apodemes strong and well defined; genital papilla large; anal plate large and distinct. Apodemes I as long as genu I, extending in posteromedial directions from innermost angles of coxae I, converging to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II about one and one-half times as long as apodemes I, extending in posteromedial directions from innermost angles of coxae II, curving abruptly forward just before juncture. Transverse apodeme absent. Anterior median apodeme strong and conspicuous, extending uninterrupted between junctures of apodemes I and II. Apodemes III about twice as long as apodemes II, extending in anteromedial directions from anterior extremities of coxae III, curving inward in smooth arcs and intersecting apodemes IV at points length of tarsus II behind main body suture. Apodemes IV subparallel to apodemes III for most of their lengths, extending from outer basal angles of coxae IV to juncture with apodemes III, here curving inward to unite medially at a point two thirds the length of tarsus II behind main body suture. Posterior median apodeme extending from point slightly caudad from juncture of apodemes IV to point nearly in transverse alignment with posterior extremities of apodemes IV, the apodeme strongest in anterior two fifths of its length. Anterior margin of propodosomal dorsal shield broadly and angularly truncate and projecting as a hood over basal fifth of capitulum. *Dorsal chaetotaxy:* First pair of dorsal propodosomal setae nearly as long as combined lengths of genu, tibia and tarsus II, situated at points two thirds the length of seta behind anterolateral angles of hood, the setae separated from each other by a distance equal to one half the length of seta; second dorsal propodosomals two thirds as long as setae of first pair, located behind and slightly laterad from first setae a distance slightly less than length of setae; third pair of setae twice as long as setae of second pair, situated behind and slightly laterad from second setae a distance equal to one third the distance separating the first and second setae; fourth pair of dorsal propodosomal setae slightly longer than setae of second pair, situated laterad from and slightly behind third setae a distance equal to one and one-half times the

distance separating second and third setae. First pair of dorsal hysterosomal setae longer than the others and slightly shorter than first dorsal propodosomals; third dorsal hysterosomal setae shorter than the others and slightly shorter than second dorsal propodosomals. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as genu I, situated slightly laterad from juncture of apodemes I; second ventral propodosomals as long as setae of first pair, situated two thirds length of seta behind apodemes II at about mid-lengths of apodemes. First ventral hysterosomals slightly longer than ventral propodosomal setae, located slightly behind apodemes III at about anterior two fifths of apodemes; second ventral hysterosomals slightly longer than setae of first pair, located slightly laterad from apodemes IV at posterior fourths of apodemes. *Capitulum*: Small, subcordate, with posterior margin rounded truncate; length, including projecting palpi, 30μ ; greatest width, measured at posterior third, 22μ . Dorsal setae as long as tarsus I, situated near anterolateral extremities of capsule. Ventral setae two thirds as long as dorsal setae, located near bases of palpi and separated from each other by a distance equal to length of seta. Palpi relatively short and of moderate robustness, projecting a short distance beyond apex of capsule. Styliform chelicerae projecting between but not beyond palpi; cheliceral sheaths without striae. *Legs*: Leg I with coxa subquadrangular, about as broad as long, without vestiture; femur short and stout, as broad at base as long, with three setae; genu broader than long, with three setae; tibia slightly longer than broad, with one small, clavate seta having length equal to one third basal width of segment, located mid-dorsally the length of seta from base of segment, one slender, rodlike seta more than twice as long as clavate seta, situated dorsally near outer margin one half length of seta from base of segment, one capitate seta slightly shorter than rodlike seta, located between the latter and the clavate seta, five normal setae; tarsus one and one-half times as long as tibia, lateral margins converging slightly toward broad apex, segment with one short, clavate, annulated seta as long as basal width of segment, located dorsally near outer basal margin, seven normal setae; tarsus surmounted by a short, slender pretarsus which subtends a small, curved claw. Leg II with coxa subquadrangular, broader than long, without vestiture; femur short and stout, as broad at base as long, with three setae; genu broader than long, with three setae; tibia as broad at base as long, with four setae; tarsus nearly twice as long as tibia, tapering from broad base to slender apex, with one large, lanceolate, annulated seta, two thirds as long as

segment, located dorsally near outer basal margin, four normal setae; tarsus surmounted by a short, slender pretarsus which subtends two small, curved, spreading claws between which projects a small empodium. Leg III with coxa of moderate length, greatest width about one half length of segment, without vestiture; femur about one half as long as coxa and about one half as broad as long, with three setae; tibia one and one-third times as long as broad, with four setae; tarsus slightly longer than tibia, tapering from base to broadly rounded apex, with three setae; tarsus surmounted by a short, slender pretarsus which subtends two small, curved, spreading claws between and beyond which projects a small, bilobed empodium. Leg IV with coxa large and subquadrangular, about one and one-third times as broad as long, with one ventral seta; femur robust, nearly two thirds as broad at base as long and one third as broad at apex as long, with one dorsal seta two thirds as long as segment, located near outer margin at apical third, one ventral seta as long as dorsal seta, situated near mid-segment at apical third, one ventral seta as long as apical width of segment, located near inner margin at basal two fifths; tibia short and stout, as broad at base as long, with one rodlike seta having length nearly equal to apical width of segment, situated dorsally near outer margin at apical third, one tactile seta longer than entire leg, situated ventrally near outer margin at apical third; tarsus twice as broad as long, with two small dorsal setae and one ventral seta; tarsus subtends a large, strong, curved claw with length equal to length of tibia. *Genital papilla*: Large and subcordate, with anterior margin emarginate, posterior margin broadly truncate; length, 26μ ; greatest width, measured at anterior fifth, 26μ . *Anal plate*: Large and well-defined, its triradiate apodemes extending a distance equal to one half the width of genital papilla; central disc situated ventrally the length of genu I anterior to anterior margin of genital papilla. *Measurements*: Length of body from tips of palpi to apex of genital papilla, 141μ ; anterior margin of cephalothoracic hood to apex of genital papilla, 126μ ; anterior margin of hood to main body suture, 47μ ; width of body at main body suture, 84μ ; width at anterior condyles of coxae III, 89μ .

Female: Body broadly oval, broadest at posterior extremities of coxae III. Legs relatively short and stout, the anterior pairs subequal in size and widely separated from posterior pairs; innermost margins of coxae IV separated from each other by a distance equal to length of coxa IV. Apodemes indistinct, those of legs I as long

as basal width of tibiotarsus I, extending in nearly transverse directions from innermost angles of coxae I and joining at mid-body. Apodemes II about twice as long as apodemes I, extending in posteromedial directions from innermost angles of coxae II and converging medially at a point midway between point of convergence of apodemes I and main body suture. Transverse apodeme apparently absent. Anterior median apodeme extending from point of convergence of apodemes I nearly to main body suture, distinct only in posterior half of its length. Apodemes of hysterosoma not clearly defined. Dorsal segmentation of hysterosoma distinct, with one well-defined suture transecting body in the region of coxae IV, three transverse sutures in opisthosoma. Dorsal plate of propodosoma projected forward to form a hood which covers posterior two thirds of capitulum, the anterior margin of hood truncate and with dimension slightly less than width of capitulum. Pseudostigmatic organs nearly as long as tibiotarsus I, with expanded apices elongate oval and about twice as long as slender pedicels. Stigmatal openings large and conspicuous, situated dorsolaterally midway between pseudostigmatic organs and anterolateral angles of hood. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae as long as tibiotarsus I, situated one third length of seta behind anterolateral angles of cephalothoracic hood; second pair of setae one and one-third times as long as setae of first pair, located the length of seta anterior to main body suture and one third this distance from lateral margins of body. First and second dorsal hysterosomal setae subequal in size, slightly shorter than first dorsal propodosomals; third, fourth, fifth and sixth pairs of setae about equal in size, one half as long as first dorsal propodosomals. *Ventral chaetotaxy*: First pair of ventral propodosomal setae nearly as long as genu I, situated one half length of seta behind apodemes I at about mid-lengths of apodemes; second ventral propodosomals one and one-half times as long as setae of first pair, located near centers of areas delimited by apodemes II, median apodeme, main body suture and inner bases of coxae II. First ventral hysterosomals as long as first ventral propodosomals, located at points three times length of seta behind main body suture and separated from each other by about this distance; second ventral hysterosomals about as long as setae of first pair, located one and one-half times length of seta anterior to outer basal angles of coxae IV; third pair of setae short, situated at apex of opisthosoma and separated by a distance equal to their combined lengths. *Capitulum*: Relatively small and subcordate, with posterior margin rounded truncate; length, including projecting palpi, 34μ ;

greatest width, measured at posterior third, 26μ . Dorsal setae as long as genu I, located near anterolateral angles of capsule. Ventral setae as long as dorsal setae, situated near bases of palpi and separated from each other by a distance equal to length of seta. Palpi short and slender, projecting slightly beyond apex of capitulum, indistinctly segmented and ornamented. Styliform chelicerae projecting between and slightly beyond apices of palpi; cheliceral sheaths without striae. *Legs:* Leg I with coxa subquadrangular, nearly as broad as long, without vestiture; femur slightly longer than broad at base, with two long ventral setae and two short dorsal setae; genu as broad at base as long, with three setae; tibiotarsus three times as long as broad at base, tapering slightly from base to broadly rounded apex, with one small, clavate seta having length equal to one third basal width of segment, situated middorsally one half length of seta from base of segment, one rodlike seta, one and one-half times as long as clavate seta, situated dorsally near inner margin one half length of seta from base of segment, one capitate seta nearly as long as rodlike seta, situated between the latter and the clavate seta, one large, clavate, annulated seta having length slightly less than basal width of segment, located dorsally near outer margin at about basal third of segment, one long, tactile seta, longer than segment, situated dorsally near outer basal margin, twelve normal setae; tarsus surmounted by a short pretarsus which subtends a strong, curved claw and a small empodium. Leg II with coxa subquadrangular, slightly broader than long, without vestiture; femur robust, as broad as long, with three setae; genu broader than long, with three setae; tibia as broad as long, with four setae; tarsus twice as long as broad at base, tapering abruptly from base to narrowly rounded apex, with one clavate, annulated seta having length nearly equal to basal width of segment, located dorsally near inner basal margin of segment, five normal setae; tarsus surmounted by a short pretarsus having imbricated lateral margins and subtending a pair of strong, curved, spreading claws between and beyond which projects a large empodium. Leg III with coxa elongate, oval, one half as broad as long, without vestiture; femur one half as long as coxa, with constriction and incomplete suture at basal two fifths of segment separating the subglobose basifemur from the telofemur, the latter with lateral margins diverging from its base to its broad apex, telofemur with three setae; tibia as long as femur, twice as long as broad at base, with four setae; tarsus slender, elongate, nearly as long as tibia, with three setae; tarsus surmounted by a short, slender pretarsus which bears at its apex two large, curved,

spreading claws between and beyond which projects a broad empodium. Leg IV with coxa subquadrangular, as broad as long, without vestiture; trochanter collarlike, broader than long, without vestiture; third segment relatively short, as long as femur III, with one ventral seta two fifths as long as segment, situated near outer margin at base of segment, one seta one half as long as segment, located ventrally near outer margin at apical third; fourth segment one third as long as third segment, its apex extending to point the length of segment before margin of body, with one stout, ventral seta as long as third segment, located near outer margin at apical two fifths, one terminal seta as long as leg IV. *Measurements*: Length of body, from tips of palpi to apex of hysterosoma, 174 μ ; anterior margin of cephalothoracic hood to apex of hysterosoma, 157 μ ; anterior margin of hood to main body suture, 40 μ ; width of body at main body suture, 77 μ ; width of body at anterior condyles of coxae III, 43 μ ; distance between innermost margins of coxae IV, 9 μ .

Types: Brownsville, Texas, Nov. 9, 1933, F. H. Benjamin, on date palm leaves.

Location of types: U. S. National Museum, two slides numbered U.S.N.M. 1127.

Additional specimens included in this study by the present author are identified with the following data: U. C. Botany Dept., Berkeley, Calif., Nov. 3, 1949, R. E. Beer, in fungus cultures (three males, one female); U. C. campus, Berkeley, Calif., July 8, 1949, R. E. Beer, in association with *Hemiberlesia rapax* infesting *Ilex aquifolium* (one male, four females); St. Marys, Ga., Nov. 11, 1937, E. V. Komarek, on *Geomys colonus* (one male, one female).

The above redescriptions were made from specimens from the Berkeley fungus culture collection. The type series is represented by three males and ten females on one slide, with most of the females and one of the males broken or missing parts, and one male and seven females on a second slide. Measurements of the single male (encircled, apparently by Ewing) on the second slide were made by the present writer and are here included: Length of body, from tips of palpi to apex of genital papilla, 134 μ ; tips of palpi to main body suture, 60 μ ; width of body just behind main body suture 90 μ ; capitulum, 30 μ long, 24 μ wide; genital papilla, 24 μ long, 26 μ wide. This specimen is hereby designated lectotype.

In the male, this species is similar to *T. pritchardi* and *T. simplex* in having the tactile seta of tibia IV very long. However, the long dorsal and ventral setae of femur IV and the long claw of leg IV

as well as the placement of the second ventral hysterosomal setae distinguish *T. texanus* from these closely related species.

Tarsonemus pritchardi, new species

(Plates 13, 20 and 24)

Male: Body broad, oval, broadest slightly behind main body suture. Apodemes conspicuous and well defined. Apodemes I as long as tibia II, extending from innermost angles of coxae I to anterior extremity of median apodeme, converging with the latter and forming a right angle with one another. Apodemes II twice as long as apodemes I, extending posteromedially from inner angles of coxae II to median apodeme, intersecting latter at a point slightly more than half the distance from anterior extremity of median apodeme to main body suture. Anterior median apodeme as long as combined lengths of genu and tibia II, extending from Y-shaped juncture of apodemes I to point of intersection of apodemes II. Transverse apodeme apparently absent. Apodemes III with posterior portion distinct, extending anteromedially from anterior extremities of coxae III a distance equal to four fifths length of coxa III, curving in transverse direction at this point, indistinctly continuing to juncture with apodemes IV. Apodemes IV extending anteromedially from outer basal angles of coxae IV, converging slightly on apodemes III, to point the length of anterior median apodeme behind main body suture, separated from posterior median apodeme at this point by a distance equal to the length of tibia II, apodemes indistinctly curving in transverse direction here, continuing to intersection with median apodeme. Posterior median apodeme conspicuous, extending from point in line with anterior extremities of coxae IV to a point the length of anterior median apodeme behind main body suture. Anterior margin of propodosoma not extended to form a cephalothoracic shield. *Dorsal chaetotaxy:* Propodosoma with first pair of setae as long as combined lengths of genu and tibia I, located one third length of seta behind anterior margin of propodosoma, separated from each other by a distance equal to two thirds length of seta; second pair of setae one half as long as first pair, situated the length of seta behind and slightly laterad from setae of first pair; third pair of setae one and one-fourth times as long as first pair, located a distance slightly less than length of second seta behind and slightly laterad from setae of second pair; fourth pair of setae as long as first pair, located a distance the length of second seta behind and slightly laterad from setae of third

pair, this position being one half length of seta from main body suture. Hysterosoma with first pair of setae as long as fourth pair of propodosomal setae, situated on lateral margins of body midway between anterior extremities of coxae III and main body suture; second pair of setae two thirds as long as setae of first pair, located near lateral margins of body in line with anterior extremities of coxae IV; third pair of setae subequal in length to setae of second pair, located nearly in transverse line with setae of second pair, separated from each other by a distance equal to their combined lengths; fourth pair of setae as long as third pair, located near caudolateral margins of body immediately beside genital papilla at its anterior fourth. *Ventral chaetotaxy*: Propodosoma with first pair of setae as long as genu II, located one half length of seta laterad from juncture of apodemes I; second pair of setae twice as long as setae of first pair, situated one fourth length of seta behind apodemes II at their mid-lengths, the length of seta from main body suture. Hysterosoma with first pair of setae one and one-half times as long as genu II, located one third the distance from apodeme III to apodeme IV at their conspicuous anterior extremities; second pair of setae slightly longer than first pair, situated in same interapodemal areas as first pair, very close to apodemes IV at their posterior thirds. *Capitulum*: Large, subcordate, posterior margin rounded, truncate, length including projecting palpi, 28μ ; greatest width, 22μ . Dorsal setae with length equal to basal width of tarsus I, situated near apex of capitulum, separated from each other by a distance equal to one and one-half times length of seta. Ventral setae as long as genu I, situated nearly opposite dorsal setae, separated from each other by a distance equal to length of seta. Palpi short, stout, indistinctly segmented, projecting a short distance beyond apex of capitulum. Chelicerae short, needlelike, projecting forward between palpi as far as tips of latter; cheliceral sheaths conspicuous, without transverse striae. *Legs*: Anterior pairs of moderate length, legs I slightly longer than legs II. Leg I with coxa subquadrangular, one and one-half times as broad as long, without setae; femur with length equal to one half greatest width of capitulum, tapering from base toward apex, with three normal setae; genu three fifths as long as femur, about as broad as long, with four setae; tibia one and one-half times as long as genu, one and one-half times as long as broad at base, tapering slightly toward apex, with one short, ovate, annulated seta with length equal to one half basal width of segment located mid-dorsally one half length of seta from base, one slender, capitate seta

slightly longer than ovate seta situated between latter and outer margin of segment, one rodlike seta with length equal to two thirds basal width of segment situated near outer margin at basal third, one tactile seta nearly twice as long as segment located middorsally slightly distad from mid-segment, four normal setae; tarsus slightly longer than tibia, nearly three times as long as broad at base, tapering to broadly rounded apex, with one short, ovate, annulated seta with length equal to three fourths basal width of segment situated middorsally at base, six normal setae; tarsus surmounted by a very short pretarsus bearing a small, curved claw, the tip of which projects beyond a broad, subcircular empodium. Leg II with coxa subquadrangular, one and one-fourth times as broad as long, without vestiture; femur as long as femur I, slightly broader than latter, with three setae; genu slightly shorter than genu I, slightly broader than long, lateral margins tapering a little from base to apex, with three setae; tibia slightly longer than genu, slightly longer than broad at base, with four normal setae; tarsus one and two-thirds times as long as tibia, two and one-half times as long as broad at base, tapering from base to narrowly rounded apex, with one very large, ovate, annulated seta with length equal to three fifths length of segment and greatest width one third its length, located middorsally at base of segment, one short, ventral, peglike seta with length equal to one half basal width of segment, located near inner margin at apex, three normal setae; tarsus surmounted by narrow pretarsus with length equal to basal width of tarsus, bearing at its apex two small, curved claws between and beyond which extends a broad, bilobed empodium. Leg III with coxa subtriangular, length equal to combined lengths of tibia and tarsus I, greatest width equal to two fifths length, without setae; femur as long as tarsus I, outer margin indented at mid-segment, basal half expanded bulbous, distal half of segment expanding slightly toward apex, with one dorsal seta; genu one half as long as femur, slightly longer than broad, sides subparallel, with three setae; tibia one and one-half times as long as genu, nearly twice as long as width at base, lateral margins subparallel, with four setae; tarsus as long as tibia, two and one-half times as long as broad at base, tapering from base to broadly rounded apex, with four normal setae; tarsus transcended by narrow pretarsus as long as basal width of tarsus, bearing at its apex two small, spreading, curved claws between and beyond which projects a broad empodium. Leg IV with coxa subtriangular, outer margin three times as long as inner margin, width of segment equal to combined lengths of genu and tibia III, length of outer margin

equal to two thirds width of segment, with one ventral seta as long as segment situated one third length of seta from outer margin at about mid-length of segment; femur twice as long as coxa, outer margin slightly convex, inner margin expanded slightly at basal third, width of segment at apex equal to one half width at base, segment with one dorsal seta one half as long as segment located on large tubercle near outer margin at apical third, one ventral seta with length equal to apical width of segment situated near inner margin at mid-segment, one seta with length equal to length of outer margin of segment located mid-ventrally at apical third; tibia and tarsus ankylosed forming a tibiotarsus with a short, indistinct vestige of a suture at apical fourth of segment, length of segment equal to apical width of femur, outer margin slightly convex, inner margin concave, with one short, narrow, ovate, annulated seta with length equal to one third basal width of segment situated dorsally near outer margin slightly distad from mid-segment, one dorsal seta having length equal to one third basal width of segment located on inner margin at apex, one stout tactile seta two and one-half times as long as segment situated ventrally near outer margin at apical third, one seta with length equal to two fifths basal width of segment located ventrally on inner margin at apical fourth; tibiotarsus terminating in a stout, curved claw with length equal to three fourths basal width of tibiotarsus, about twice as long as broad at base. *Genital papilla*: Length, 22μ ; width, 23μ ; subcor-date, with anterior margin emarginate, posterior margin broadly truncate and with two short caudolaterally projecting horns. *Measurements*: Length from tip of capitulum to apex of genital papilla, 136μ ; main body suture to apex of genital papilla, 74μ ; anterior margin of propodosoma to main body suture, 38μ ; width at main body suture, 65μ ; width at anterior extremities of coxae III, 67μ .

Female: Body broadly oval, broadest at mid-length, lateral margins subparallel between legs II and III. Anterior pairs of legs short and stout, legs II immediately adjacent to legs I, these widely separated from posterior pairs. Apodemes inconspicuous, those of legs I indistinctly converging medially just behind anterior extremity of ventral plate, the latter clearly delimited by an unbroken undulating line extending from hind margins of coxae II to mid-body immediately behind capitulum. Apodemes II indistinct, extending in posteromedial directions from inner angles of coxae II a distance equal to length of femur II terminating two fifths length of apodeme from median apodeme. Anterior median apodeme

visible as a broken line, extending from point just behind intersection of apodemes I to main body suture. Transverse apodeme apparently absent. Apodemes III barely visible, extending in anteromedial directions from anterior extremities of coxae III a distance equal to one third length of coxa III. Apodemes IV indistinct. Posterior median apodeme visible as a faint broken line, extending medially from point in line with posterior thirds of coxae III to point the width of coxa III behind main body suture, bifurcate a short distance before anterior extremity. Three transverse hysterosomal body sutures distinct dorsally, one transecting body at posterior extremities of coxae III, one at a point one fifth the distance from coxae IV to apex of opisthosoma, one at apical fifth of opisthosoma. Propodosoma extended dorsally forming a broadly rounded cephalothoracic shield which projects anteriorly over basal two thirds of capitulum, posterolateral extremity of shield at stigmatal openings, lateral margins of body expanding at these points. Pseudostigmatic organs shorter than tibiotarsus I, about as long as combined lengths of genu and tibia II; expanded apex elongate oval, one and one-fourth times as long as narrow pedicel, nearly twice as long as greatest width; areoli conspicuous, diameter equal to three fourths width of expanded apex of organ. Stigmatal openings distinct as heavily sclerotized rings with diameter equal to one half diameter of areolus of pseudostigmatic organ, situated two thirds length of pseudostigmatic organs in front of and slightly medial to same, openings separated from each other by a distance equal to one and one-third times greatest width of capitulum. *Dorsal chaetotaxy:* Propodosoma with first pair of setae as long as tibiotarsus I, situated one fourth the length of seta from margins of cephalothoracic shield at points one half the distance from anteromedial extremity to stigmatal openings; setae of second pair one and one-third times as long as setae of first pair, located one third length of seta behind and slightly medial to areoli of pseudostigmatic organs. Hysterosoma with first pair of setae as long as combined lengths of genu and tibia II, located on lateral margins of body the length of seta behind posterior margins of coxae II; second pair of setae with length subequal to length of first pair, located slightly more than the length of seta from lateral margins of body about in line with anterior extremities of coxae III; setae of third pair two thirds as long as setae of first pair, situated one half length of seta anterior to hysterosomal suture transecting body at basal fifth of opisthosoma, separated from each other by a distance equal to four times length of seta; fourth pair of setae subequal in length

to third pair, one half as long as tibia III, located on lateral margins of body one half length of seta anterior to last opisthosomal suture; setae of fifth and sixth pairs as long as setae of fourth pair, located one half length of seta from last opisthosomal suture, separated from each other by a distance equal to one and one-half times length of seta. *Ventral chaetotaxy*: Propodosoma with first pair of setae as long as genu II, located one half length of seta from anterior margin of ventral plate, this distance from median apodeme; setae of second pair twice as long as setae of first pair, situated on apodemes II at about their mid-lengths. Hysterosoma with first pair of setae having length equal to width of genu II, located just anterior to anteromedial extremities of apodemes III; setae of second pair with length subequal to setae of first pair, located one half greatest width of coxa III mesad from inner margins of coxae III at their posterior two fifths; third pair of setae with length equal to length of terminal segment of leg IV, located near apex of body and separated from each other by a distance equal to one and one-half times length of seta. *Capitulum*: Subcordate with posterior margin rounded truncate; length including projecting palpi, 36μ ; width at greatest dimension, 25μ . Dorsal setae as long as genu II, located in line with bases of palpi and separated from each other by a distance equal to length of seta. Ventral setae as long as dorsal setae, located in line with the latter and separated from each other by a distance equal to three fourths length of seta. Palpi short and stout, indistinctly segmented, their bases inserted on apical fifth of capitulum. Chelicerae short, needlelike, projecting forward between palpi to a point in line with apices of the latter; cheliceral sheaths prominent, without striae. *Legs*: Anterior pairs short and stout. Leg I with coxa subtriangular, one and one-half times as broad as long, without setae; femur with length equal to one half width of capitulum, inner margin one half as long as outer, segment with greatest width equal to length, tapering from base toward apex, with one stout, elongate seta and three normal setae; genu two thirds as long as femur, slightly longer than broad, with four normal setae; tibiotarsus stout, twice as long as genu, three times as long as broad at base, tapering slightly from base to broadly rounded apex, with one capitate, annulated seta with length equal to one half basal width of segment, located dorsally one half the length of seta from base on outer margin of segment, one rod-like seta slightly longer than capitate seta, located dorsally near outer margin at basal sixth, one seta nearly as long as segment located dorsally near outer margin at basal sixth, one seta one third

as long as segment located middorsally at basal fifth, one clavate, annulated seta with length equal to two thirds basal width of segment located dorsally near outer margin at basal third, one seta one half as long as segment located near outer margin at apical third, one stout, curved seta one third as long as segment located middorsally at apex, one ventral seta one half as long as segment located near outer margin at basal fourth, one ventral seta one half as long as segment located near inner margin at basal third, one mid-ventral seta one third as long as segment located at about mid-segment, one ventral seta one third as long as segment located on inner margin at apical third, one ventral seta one third as long as segment located on outer margin at apical third, one stout, curved seta one fourth as long as segment located ventrally on inner margin at apex, one stout, curved, ventral seta one third as long as segment located near outer margin just before apex; tarsus surmounted by a short pretarsus bearing at its apex a small, curved claw and small empodium. Leg II with coxa subquadrangular, as broad as long, length equal to length of genu I, without vestiture; femur slightly longer than femur I, slightly longer than broad, tapering toward apex, with three normal setae; genu one half as long as femur, as long as broad at base, tapering slightly toward apex, with three setae; tibia one and one-fourth times as long as genu, one and one-fourth times as long as broad, lateral margins subparallel, with four setae; tarsus one and one-half times as long as tibia, two and one-half times as long as broad at base, tapering from base to narrowly rounded apex, with one dorsal, peglike seta with length equal to one half basal width of segment located near outer margin at base, one ovate, annulated seta as long as peglike seta, located on outer margin near base, five normal setae; tarsus terminated by a narrow pretarsus, its length equal to basal width of tarsus and bearing at its apex two stout, curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa elongate oval, length equal to combined lengths of genu and tibio-tarsus I, one third as broad as long, lateral margins convex at anterior two thirds, constricted at posterior third, expanding caudad from this point, segment without vestiture; femur nearly one half as long as coxa, outer margin constricted at basal two fifths of segment expanding bulbous basad from this point, sides diverging distad from constriction, segment with two setae; tibia slightly longer than femur, lateral margins converging slightly from basal third toward apex, with three setae; tarsus narrow, elongate, length equal to length of femur, lateral margins subparallel, segment with

three setae; tarsus exceeded by a narrow pretarsus one third as long as tarsus, bearing at its apex two curved, spreading claws between and beyond which extends a broad empodium. Leg IV with coxa small, subtriangular, broader than long, without vestiture; trochanter small, ringlike, one and one-half times as broad as long, without setae; third segment slender, elongate, as long as tibiotarsus I, outer margin straight, inner margin slightly concave, segment with one ventral seta one third as long as segment, located on outer margin at base, one seta two thirds as long as segment located ventrally near outer margin at apical third; fourth segment narrow, elongate, three times as long as broad at base, expanded slightly at apex, with one stout seta as long as combined lengths of third and fourth segments, located near outer margin at apical third, one terminal seta nearly twice as long as leg IV. *Measurements*: Apex of cephalothoracic shield to tip of opisthosoma, 148 μ ; tip of shield to main body suture, 61 μ ; width of body at main body suture, 74 μ ; width at anterior extremities of coxae III, 88 μ ; distance between anterior condyles of coxae III, 47 μ .

Holotype: Male from Avancino-Mortensen nursery San Leandro, California, September 26, 1949, R. E. Beer, on dead flower of *Spathiphyllum*.

Allotype: Female, same data as holotype.

Paratypes: Five males, ten females and one larva, same data as holotype.

Location of types: Holotype, allotype, three male and six female paratypes, with the same data as the holotype, in the Snow Entomological Museum, University of Kansas. Two male and four female paratypes, with the same data as the holotype, in the U. S. National Museum.

This species is distinguished from *T. confusus* and *T. waitei*, with which it seems to bear a close affinity, on characters of the male leg IV and the presence of an elongate extra seta on femur I of the female.

Living specimens of this species are opaque white in the immature and young adult stages, the older adults becoming a slight amber color. This species is definitely a fungus feeder. In biological investigations conducted by the present writer several generations were reared on agar slants containing cultures of fungus (unidentified) taken from dead flowers of *Spathiphyllum* sp. from the type locality.

During the course of biological studies "pupae" of this species were

observed being carried by males of *Tarsonemus setifer* which were introduced into the culture.

This species was named after Dr. A. Earl Pritchard of the University of California, who was instrumental in arousing the interest of the present author in the family Tarsonemidae.

Tarsonemus unguis Ewing

(Plates 12 and 20)

Tarsonemus unguis Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 30.

Male: Body broadly oval, broadest near posterior extremities of coxae III; legs moderately long and robust, with legs I slightly longer than legs II; apodemes distinct and clearly defined; genital papilla smaller than capitulum; anal plate relatively small. Apodemes I as long as inner margin of femur I, extending in postero-medial directions from innermost angles of coxae I, converging medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II about one and one-half times as long as apodemes I and subparallel to the latter for most of their lengths, extending from innermost angles of coxae I and curving rather abruptly in a posterior direction just before mid-body, terminating a short distance beyond the curve, the rather indistinct mesal terminations of these apodemes separated from each other by a distance equal to the basal width of tarsus II and the length of tibia II anterior to main body suture. Transverse apodeme apparently absent or very obscure. Anterior median apodeme extending from point of juncture with apodemes I to a point in transverse alignment with the curves just before the mesal extremities of apodemes II. Apodemes III strong and distinct, extending in smooth, anteromesally directed arcs from anterior condyles of coxae III to juncture with apodemes IV at points the length of tibia II laterad from median apodeme. Apodemes IV extending in anteromedial directions from outer basal angles of coxae IV, converging gently with apodemes III and extending in a short transverse arc after juncture with apodemes III to point of contact with median apodeme, this point being one and one-half times the length of tibia II behind main body suture. Posterior median apodeme extending from point slightly anterior to juncture of apodemes IV to point slightly anterior to inner basal angles of coxae IV, bifurcating here with each short arm of the apodeme continuing to inner basal angles of coxae IV, this apodeme discontinuous for a short distance in two places, one immediately behind juncture of apodemes IV, the

other slightly anterior to bifurcation. A hysterosomal suture transects body dorsally near anterior extremity of genital papilla. Dorsum of propodosoma with anterior margin broadly and angularly truncated, its transverse dimension slightly exceeding the width of capitulum and equal to the combined lengths of femur, genu and tibia I. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae with length equal to twice length of tarsus I, situated one third length of seta behind anterior margin of propodosoma and separated from each other by a distance equal to one half length of seta; second pair of setae with length equal to four fifths the length of first setae, situated behind and slightly laterad from setae of first pair a distance about equal to one half length of first seta; third setae more than twice as long as setae of first pair, situated behind and slightly laterad from second setae a distance equal to that separating first and second setae; fourth pair of dorsal propodosomals about as long as first setae, situated laterad from third setae a distance equal to slightly less than one half the distance separating second and third setae. First pair of dorsal hysterosomal setae as long as first propodosomals, located near lateral margins of body four fifths length of seta behind main body suture; second and third pairs of setae subequal in size, four fifths as long as setae of first pair; fourth dorsal hysterosomal setae one-half as long as third setae, situated at lateral margins of genital papilla at about mid-length of papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as genu II, situated two thirds length of seta laterad from juncture of apodemes I; second pair of setae as long as first pair, located near centers of areas delimited by apodemes II, main body suture and basal margins of coxae II. First pair of ventral hysterosomal setae nearly twice as long as first ventral propodosomals, located immediately behind apodemes III at mesal thirds of these apodemes; second pair of setae three fourths as long as first ventral hysterosomal, situated on apodemes IV midway between posterior extremities of apodemes and points of juncture with apodemes III. *Capitulum*: Subcordate with anterior margin rounded and having a slight mesal emargination; length including projecting appendages, 30μ ; greatest width, measured at about mid-length, 30μ . Dorsal setae short, length equal to one fourth width of capitulum and situated near anterolateral angles of capsule, separated from each other by a distance equal to their combined lengths. Ventral setae slightly shorter than dorsal setae, situated near palpal bases and separated from each other by a dis-

tance equal to one and one-half times length of seta. Palpi short and stout, projecting a short distance beyond apex of capsule, indistinctly segmented and ornamented. Styliform chelicerae short, projecting between but not beyond palpi; cheliceral sheaths without transverse striae. *Legs:* Leg I with coxa subquadrangular, about one and one-third times as broad as long, without vestiture; femur robust, length equal to width of coxa, with four setae; genu slightly broader than long, with four setae; tibia slightly longer than broad, with one small, clavate, annulated seta with length equal to two fifths basal width of segment, located mid-dorsally the length of seta before base of segment, one rodlike seta about one and one-half times as long as segment, located dorsally near outer margin one half length of segment from base, one capitate seta as long as rodlike seta, situated between the clavate and the rodlike setae, four normal setae; tarsus one and one-half times as long as tibia, twice as long as broad at base, tapering from base to narrowly rounded apex, with one stout, lanceolate, annulated seta with length equal to three fourths basal width of segment, situated dorsally near outer margin the length of seta from base of segment, six normal setae; tarsus surmounted by a short, slender pretarsus which subtends a small, curved claw and a small empodium. Leg II with coxa subquadrangular, one and one-third times as broad as long, without vestiture; femur robust, as broad as long, with two small setae; genu one and one-half times as broad as long, tapering slightly from base to apex, with three setae; tibia one and one-half times as long as genu, tapering from base toward apex, with four normal setae; tarsus slightly longer than tibia, more than twice as long as broad at base, tapering from base to narrowly rounded apex, with one large, clavate, annulated seta with length equal to basal width of segment, situated dorsally near inner margin at base of segment, four normal setae; tarsus surmounted by a short, slender pretarsus which subtends two large, curved, spreading claws between which projects a broad empodium. Leg III with coxa about twice as long as broad, without vestiture; femur two thirds as long as coxa and one half as broad as long, basal third of segment bulbous and separated from remainder of segment by a slight constriction and an incomplete suture, the telofemur with one ventral seta; genu about two fifths as long as femur, as broad as long, with three setae; tibia slightly longer than genu, with four setae; tarsus slightly longer than tibia, about twice as long as broad at base, tapering from base to narrowly rounded apex, with three setae; tarsus subtends a short, slender pretarsus which bears at its apex two large, curved, spreading claws

between and beyond which projects a broad, bilobed empodium. Leg IV with coxa large and subquadrangular, about three fourths as long as broad, with one ventral seta; femur robust, length equal to one and one-half times width of coxa, about twice as long as broad at base and one half as broad at apex as at base, with one long, dorsal seta as long as segment, situated near apical third on outer margin, one ventral seta as long as basal width of segment, located near apex of inner margin, one small, ventral seta having length equal to one half apical width of segment, located on inner margin at basal two fifths; tibia short and stout, about as broad as long, with one stout, tactile seta nearly as long as femur, located mid-ventrally at apex of segment, one slender, rodlike seta with length equal to three fourths width of segment, situated near outer margin at about mid-segment; tarsus collarlike, about twice as broad as long, with two short dorsal setae and one short ventral seta; tarsus subtends a large, curved claw with length equal to length of tibia. *Genital papilla*: Large and subcircular in general outline with a slight mesal emargination on its anterior margin; length, including projecting appendages, 26 μ ; greatest width, measured at mid-length, 26 μ . *Anal plate*: Relatively small but conspicuous, its triradiate apodemes projected to an expanse equal to one half width of capitulum. *Measurements*: Total length, from tips of palpi to apex of genital papilla, 174 μ ; anterior margin of propodosomal hood to apex of genital papilla, 150 μ ; anterior margin of hood to main body suture, 78 μ ; width of body near mid-lengths of coxae III, 97 μ .

Type: Belle, Maryland, Oct. 16, 1933, F. F. Smith. strawberry (single male).

Location of type: U. S. National Museum, slide number 1126.

The above description was made from the holotype specimen and the species remains known from this single specimen.

Tarsonemus scaurus Ewing

(Plates 14, 20 and 24)

Tarsonemus scaurus Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 28.

Male: Body broadly oval, broadest immediately behind main body suture; legs moderately long and of medium robustness, with legs I slightly longer than but not as stout as legs II, legs IV relatively small; genital papilla large and conspicuous, much broader than capitulum; anal plate large and well defined. Apodemes strong and distinct, those of legs I, as long as genu I, extending in postero-medial directions from innermost angles of coxae I, converging

medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II two and one-half times as long as apodemes I and subparallel to the latter, extending from innermost angles of coxae II almost to juncture with median apodeme, the mesal extremities of apodemes II curved toward posterior just before juncture with median apodeme. Transverse apodeme strong and conspicuous, transecting body just anterior to main body suture, the lateral extremities located the length of genu II behind the outer basal angles of coxae II, the apodeme curved slightly forward just before juncture with median apodeme. Anterior median apodeme strong and distinct for most of its length, extending from juncture of apodemes I to intersection with transverse apodeme. Apodemes III clear and distinct for their entire lengths, extending in anteromedial directions from anterior condyles of coxae III for a distance equal to combined lengths of genu and tibia II, here starting a smooth, ninety degree curve to join apodemes IV. Apodemes IV nearly parallel to apodemes III for most of their lengths, extending from outer, basal angles of coxae IV to point of juncture with apodemes III, here being separated from each other by a distance equal to length of tibia II, smoothly curving mesially from points of juncture with apodemes III to converge at anterior extremity of median apodeme, these short, anteromesal portions of apodemes IV being much weaker than remainder of their lengths. Posterior median apodeme with anterior extremity behind main body suture a distance equal to combined lengths of tibia and tarsus II, extending caudad to point between inner apical angles of coxae IV, the apodeme strong and distinct for its entire length. A distinct hysterosomal suture transects body dorsally in region of posterior extremities of coxae III. Dorsum of propodosoma with anterior margin angularly and broadly truncate, this margin being as broad as capitulum and forming a hood over extreme posterior portion of capitulum. *Dorsal chaetotaxy:* First pair of dorsal propodosomal setae as long as capitulum, situated one half length of seta behind anterior margin of hood, nearly this distance from lateral margins of propodosomal plate, the setae separated from each other by a distance about equal to one half width of anterior margin of cephalothoracic hood; second pair of setae two thirds as long as setae of first pair, situated behind and slightly laterad from the latter a distance equal to length of second setae; third pair of dorsal propodosomal setae nearly twice as long as setae of first pair, located behind and slightly laterad from second setae a distance slightly less than that separating first and second setae; fourth pair of setae as long but not as stout as first

setae, located laterad from and slightly posterior to third setae, separated from the latter by a distance equal to one half the distance between first and second setae. First pair of dorsal hysterosomal setae with size subequal to fourth propodosomals, situated near lateral margins of body the length of seta behind main body suture; second setae stouter and slightly shorter than setae of first pair; third dorsal hysterosomals stout, nearly as long as setae of second pair; fourth pair of setae also stout, about two thirds as long as setae of second pair, located at lateral margins of genital papilla near mid-length of papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to basal width of tarsus I, located the length of seta laterad from point of juncture of apodemes I; second ventral propodosomals slightly longer than setae of first pair, situated the length of seta behind apodemes II at about mid-lengths of apodemes. First pair of ventral hysterosomal setae one and one-half times as long as second ventral propodosomals, located immediately behind the most anterior points of the arcs formed by apodemes III at the anteromesal extremities of these apodemes; second pair of setae slightly shorter than setae of first pair, situated on apodemes IV at about the posterior two fifths of the lengths of apodemes. *Capitulum*: Small and subcordate, with posterior margin rounded, truncate and having a slight, mesal invagination. Length, including projecting palpi, 22μ ; greatest width, measured at posterior fourth, 18μ . Dorsal setae with length equal to one half width of capitulum, situated near anterolateral extremities of capsule. Ventral setae slightly shorter than dorsal setae, located near bases of palpi and separated from each other by a distance equal to length of seta. Palpi moderately short and stout, projecting a short distance beyond apex of capitulum, indistinctly segmented and ornamented. Styloform chelicerae short, projecting between but not beyond palpi; cheliceral sheaths without striae. *Legs*: Leg I with coxa subquadrangular, slightly broader than long, without vestiture; femur of moderate size, one and one-third times as long as broad, with three setae; genu slightly longer than broad, with four setae; tibia slightly longer than genu, with one small, clavate, annulated seta having length equal to one third basal width of segment located dorsally near outer margin the length of seta from base of segment, one capitate seta slightly longer than clavate seta, situated beside the latter, five normal setae; tarsus moderately slender and elongate, about four times as long as broad at base, tapering slightly toward broadly rounded apex, with one large, lanceolate, annulated seta having length slightly greater than basal width of segment,

located dorsally, near outer margin one third length of seta from base of segment, five normal setae; tarsus surmounted by a short, slender pretarsus bearing at its apex a long, curved claw and a large empodium. Leg II with coxa subquadrangular, as broad as long, without vestiture; femur nearly as broad as long, outer margin twice as long as inner margin, with two setae; genu as broad as long, with three setae; tibia one and one-half times as long as broad, with four setae; tarsus one and one-half times as long as tibia, about three times as long as broad at base, tapering from base to narrowly rounded apex, with one large, broad, lanceolate, annulated seta two fifths as long as segment, located dorsally near inner margin one half greatest width of segment from its base, four normal setae; tarsus surmounted by a short, broad pretarsus which subtends two large, curved, spreading claws between which projects a broad empodium. Leg III with coxa moderately long, length equal to one and one-half times its greatest breadth, without vestiture; femur slightly more than one half as long as coxa, segment divided into a bulbous basifemur and a broad telofemur by an incomplete suture and a conspicuous constriction, telofemur expanding toward apex and bearing one small, ventral seta; genu one half as long as femur, about as broad as long, with three setae; tibia slightly longer than genu, one and one-third times as long as broad, with four setae; tarsus slightly longer than tibia and with a slight taper from base to broadly rounded apex, with three setae; tarsus surmounted by a short, broad pretarsus with imbricated margins which subtends two large, curved, spreading claws between which projects a broad empodium. Leg IV with entire length, excluding claw, equal to combined lengths of femur, genu, tibia and tarsus III; coxa subtriangular, slightly broader than long, with one ventral seta; femur with outer margin nearly straight, as long as combined lengths of femur and genu III, inner margin slightly longer than outer margin and sharply angulate at basal sixth, converging with outer margin uniformly distad from this angle, width of segment at base equal to one half length of outer margin and twice width of segment at apex, with one dorsal seta two thirds as long as segment, situated near outer margin the apical width of segment before apex, one stout ventral seta four fifths as long as segment, located near inner apical margin of segment, one small ventral seta having length equal to apical width of segment, situated on inner margin at basal two fifths; tibia short, slightly longer than broad, with one rodlike seta having length equal to width of segment, situated dorsally near outer margin at mid-segment, one stout ventral seta with length equal

to combined lengths of femur and tibia, situated at apex of segment, its areolus with diameter almost equal to width of segment; tarsus small and inconspicuous, one half as long as broad, with two small dorsal setae and one small ventral seta; tarsus subtends a strong, sharp, slightly curved claw with length equal to length of tibia. *Genital papilla*: Large and broadly subcordate, with anterior margin deeply emarginate; length, 23μ ; greatest width, measured near anterior extremity, 33μ . *Anal plate*: Large and conspicuous, the central disc with diameter equal to apical width of femur IV, triradiate apodemes each as long as genu III. *Measurements*: Length of body from tips of palpi to apex of genital papilla, 150μ ; anterior margin of cephalothoracic hood to apex of genital papilla, 130μ ; anterior margin of hood to main body suture, 45μ ; width of body immediately behind main body suture, 75μ ; width at anterior condyles of coxae III, 67μ .

Female: Body broad, oval, broadest slightly behind main body suture. Legs moderately short and stout, legs I longer than but not as stout as legs II; innermost angles of coxae IV separated by a distance slightly greater than length of coxa IV. Apodemes moderately well-defined, those of legs I as long as basal width of tibiotarsus I, extending in posteromedial directions from innermost angles of coxae I, converging to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II twice as long as and subparallel to apodemes I, extending from innermost angles of coxae II to points the length of apodeme I laterad from median apodeme. Transverse apodeme moderately strong and distinct, transecting body immediately anterior to main body suture, less distinct mesially than at its lateral extremities. Anterior median apodeme distinct only from point of convergence of apodemes I to point in line with mesal extremities of apodemes II. Apodemes III distinct only for a short distance extending anteromedially from anterior condyles of coxae III. Apodemes IV distinct only for a short distance in the region of posterior fifths of coxae III. Posterior median apodeme relatively inconspicuous. Transverse body sutures, except for main body suture, indistinct due to poor condition of specimen. Dorsum of propodosoma with anterior margin broadly rounded, projecting over basal half of capitulum. Pseudostigmatic organs with expanded apices broadly oval, the diameter of expansion subequal to length of slender pedicel. Stigmatal openings clear and distinct, situated near lateral margins of propodosoma immediately posterior to the lateral indentations which separate

the main dorsal plate of the propodosoma from the hoodlike anterior extension. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae with length about equal to two thirds width of capitulum, situated near lateral margins of hood at about mid-length of hood; second dorsal propodosomals longer than leg I, situated midway between stigmal openings and main body suture. First pair of dorsal hysterosomal setae slightly shorter than first propodosomals, located near lateral margins of body one half length of seta from main body suture; remaining dorsal hysterosomal setae not clearly identifiable in the specimen studied. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to two thirds basal width of tibiotarsus I, situated slightly behind apodemes I at their mid-lengths; second pair of setae one and one-half times as long as setae of first pair, situated on apodemes II at mid-lengths of apodemes. First and second pairs of ventral hysterosomal setae not identifiable due to poor condition of specimen. *Capitulum*: Large and broadly subcordate, with posterior margin rounded truncate; length, including projecting palpi, 32μ ; greatest width, measured at posterior sixth, 28μ . Dorsal setae with length equal to one fourth width of capitulum, situated near anterolateral extremities of capsule. Ventral setae with length subequal to dorsal setae, situated near bases of palpi and slightly more approximate to each other than are the dorsal setae. Palpi short and stout, projecting a short distance beyond apex of capitulum, indistinctly segmented and ornamented. Chelicerae short and styliform, projecting between but not beyond palpi; cheliceral sheaths without striae. *Legs*: Leg I with coxa subquadrangular, as broad as long, without vestiture; femur slightly longer than broad, with four setae; genu as broad as long, with four setae; tibiotarsus about three times as long as broad at base, tapering from base to broadly rounded apex, with one small, clavate, annulated seta having length equal to one third basal width of segment, situated dorsally near outer margin one half length of seta from base of segment, one capitate seta as long as clavate seta, situated beside the latter, one rodlike seta about twice as long as clavate seta, situated ventrally immediately beside capitate seta, one large, broad, lanceolate, annulated seta with length equal to three fourths basal width of segment, situated dorsally near outer margin just proximad from mid-segment, one extremely long tactile seta as long as combined lengths of tibiotarsus and pretarsal elements, eight normal setae; tibiotarsus surmounted by a short, broad pretarsus bearing at its apex a strong, curved claw and a small empodium. Leg II with coxa subquadrangular, as

broad as long, without vestiture; femur robust, as broad as long, with three setae; genu as broad as long, with one stout, spinelike seta as long as segment, situated dorsally near outer margin at base, two normal setae; tibia as long as genu, as broad as long, with four normal setae; tarsus one and one-half times as long as tibia, tapering from broad base to narrowly rounded apex, with one clavate, annulated seta having length equal to one half basal width of segment, situated dorsally near outer basal margin, one spinelike seta slightly shorter than clavate seta situated dorsally between clavate seta and base of segment, one short, spurlike process projecting ventrally from inner apical margin of segment, three normal setae; pretarsal elements missing on specimen being described here. Leg III with coxa broad and elongate, without vestiture; femur as long as tibiotarsus I, basal two fifths of segment expanded, bulbous and separated from telofemur by a distinct constriction and an incomplete suture, telofemur expanding slightly from constriction toward its apex and bearing two setae; tibia as long as femur, sides slightly convex, with four normal setae; tarsus slender, elongate, about five times as long as broad, three fourths as long as tibia, with three long and one very short setae; pretarsal elements missing on specimen being described. Leg IV with coxa subtriangular, slightly longer than broad, without vestiture; trochanter small, collarlike, without a setae; third segment slightly longer than tibiotarsus I, about six times as long as broad at base, sides subparallel for most of their lengths, with one ventral seta two fifths as long as segment, situated near outer margin just before base, one seta one third as long as segment, located ventrally near outer margin one half length of seta before apex; fourth segment relatively short, less than one fourth as long as third segment, with one stout ventral seta as long as third segment, situated near outer margin at mid-segment, one teminal seta one and one-half times as long as the subterminal seta. *Measurements:* Length of body from tips of palpi to apex of hysterostoma, 138 μ ; anterior margin of cephalothoracic hood to tip of hysterostoma, 165 μ ; anterior margin of hood to main body suture, 71 μ ; width of body just posterior to main body suture, 122 μ ; distance between innermost margins of coxae IV, 21 μ .

Types: Belle, Maryland, June 15, 1933, F. F. Smith, on strawberry (one male, two females, one larva).

Location of types: U. S. National Museum, number 1125.

The type specimens mounted on a single slide were remounted with one specimen on each of four slides. All specimens were

poorly oriented on the original slide and the females were badly damaged in remounting, the male remaining in good condition. The redescription of the female given above was made from one of the cotype series, which, though damaged extensively presented the best material from which to draw a description. The male description given above was made from a specimen collected at Salem, N. J. as noted below. The male specimen in the series of four mites mounted on the "type" slide is hereby designated lectotype.

Material studied by the present writer, in addition to the cotype series, is identified with the following data: Salem, N. J., Sept. 21, 1949, John P. Reed, on tomato (several males); Univ. of Kansas campus, Lawrence, Kans., Mar. 22, 1951, R. E. Beer, leaf mold litter (three males).

This species is most easily confused with *T. confusus*, principally due to the fact that in the males of both species the femora IV are bent at a sharp angle just before the base of the segment. However, in specimens well oriented on the slide, the large acuminate claw of *T. scaurus* readily distinguishes the two, for males of *T. confusus* have very short claws. Also, the apodemes IV of *T. scaurus* are much more approximate to the median apodeme near their anterior extremities than are these apodemes in *T. confusus*. Females must be separated by more detailed characteristics, but in this sex the two mesal notches in the transverse apodeme of *T. confusus* ordinarily presents a good character for differentiation.

Tarsonemus truncatus Ewing

Tarsonemus truncatus Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 49.

This species is known from females only, three specimens mounted on a single slide representing the type series. The type slide is identified with the following data: Coeur d'Alene, Idaho, Aug. 15, 1931, H. J. Rust, on *Ips oregoni*. All specimens, although apparently in good condition, are oriented poorly on the slide and hence defied critical examination and attempts at formulating an adequate redescription by the present author.

One distinctive character readily separates this species from other known members of the family. This character is the reticulated integument, which has the undulating longitudinal striations slightly more pronounced than the wavy transverse striations. The eight pairs of dorsal body setae are stout, with the second dorsal propodosomals about twice as long as members of the other pairs. The stigmatal openings are prominent and are situated at indentations of

the margins of the propodosomal shield which occur at the postero-lateral extremities of the cephalothoracic hood, the latter having the width of its broadly rounded anterior margin slightly greater than width of capitulum and projecting to overhang basal half of capitulum. Dimensions of one of the cotype specimens are as follows: Length from tips of palpi to apex of opisthosoma, 140 μ ; greatest width of body, 84 μ ; tips of palpi to main body suture, 90 μ ; length of capitulum, including slightly projecting palpi, 30 μ ; greatest width of capitulum, 21 μ .

Types: Three females, Coeur d'Alene, Idaho, Aug. 15, 1931, H. J. Rust, on *Ips oregoni*. One of the specimens has been encircled by the present writer and this specimen is hereby designated lectotype.

Location of types: U. S. National Museum, slide number 1135, further identified with the following: Hopk. U. S. 20258.

In general appearance this species seems to bear the nearest resemblance to *T. randsi* but may readily be distinguished on the basis of its integumental reticulations.

Genus *Rhynchotarsonemus*, new genus

This genus may be distinguished from all other tarsonemids by the pronounced prolongation of the palpi, in both sexes, which extend anteriorly to form a snoutlike extension of the capitulum. The genus is erected to include a single hitherto undescribed species.

Type of genus: *Rhynchotarsonemus niger*, new species.

In general characters this genus appears to bear a rather close resemblance to *Tarsonemus*. The conservative development of the male hind legs, general body structure and the indications of its fungivorous feeding habits have led this writer to place it as one of the unspecialized groups.

Rhynchotarsonemus niger, new species

(Plates 16, 21 and 25)

Male: Body broadly oval, broadest at middles of coxae III, tapering abruptly caudad from this point. Dorsum of propodosoma projected anteriorly forming a broad cephalothoracic shield with a truncate anterior margin as broad as capitulum. Legs narrow, elongate. Apodemes conspicuous and well defined, those of legs I extending from inner angles of coxae I at nearly right angles to median apodeme, curving abruptly caudad just before intersecting the latter; apodemes II extending from inner anterior margins of

coxae II in a posteromedial directions terminating just before juncture with anterior median apodeme. Anterior median apodeme extending with interruptions from juncture of apodemes I to main body suture. Apodemes III extending in anteromedial directions from anterior extremities of coxae III, curving abruptly in transverse directions at points the length of tibia I behind main body suture, intersecting apodemes IV nearly midway between incurved angles and median apodeme. Apodemes IV subparallel to apodemes III for most of their lengths, extending from anterolateral angles of coxae IV, curving inward abruptly at anterior extremities of apodemes III, intersecting median apodeme at right angles. Posterior median apodeme extending from point the length of tibia I behind main body suture to inner basal angles of coxae IV, apodeme bifurcate at posterior third. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae; first pair as long as capitulum, situated near anterolateral angles of cephalothoracic shield; setae of second pair about one half as long as first pair, located one half length of seta behind setae of first pair and equidistant from lateral margins of body; fourth pair of setae subequal in length to setae of second pair, located between setae of third pair and lateral margins of body, slightly behind the former. Hysterosoma with four pairs of dorsal setae; first pair slightly longer than fourth pair of propodosomal setae, located near lateral margins of body opposite transverse line formed by anterior extremities of apodemes III and IV; second pair of setae stouter and slightly shorter than first pair, located near lateral margins of body opposite middles of coxae III; setae of third pair similar to setae of second pair, situated near caudolateral margins of hysterosoma; setae of fourth pair equal in length to setae of third pair but not as stout, situated near mid-lengths of lateral margins of genital papilla. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair with length equal to length of genu I, located three fourths length of seta from median apodeme, one third length of seta behind apodemes I; second pair of ventral propodosomal setae as long as first pair, located one half length of seta directly behind apodemes II at their mid-lengths. Hysterosoma with two pairs of ventral setae, both pairs situated in interapodemal areas delimited by apodemes III and IV; setae of first pair slightly longer than tarsus III, located near apodemes III half length of seta behind anterolateral extremities of interapodemal areas; second pair of setae one and one-fourth times as long as first pair, located on apodemes IV the length of seta from posterior extremities of apodemes. *Capitulum*: Subcor-

date, with posterior margin emarginate, palpi and chelicerae extending beyond apex of capitulum a distance equal to one half greatest width of capitulum; length including projecting appendages, 40μ ; greatest width, 22μ . Dorsal setae with length equal to one half greatest width of capitulum, situated near apex of capitulum, separated from each other by a distance equal to two thirds length of seta. Ventral setae nearly as long as dorsal setae, located opposite the latter. Palpi narrow, elongate, indistinctly segmented, length equal to combined lengths of tibia and tarsus I. Chelicerae needle-like, projecting forward between palpi, their apices nearly in line with apices of palpi; cheliceral sheaths prominent, without striae. *Legs*: Narrow, elongate, anterior pairs subequal in size. Leg I with coxa subquadrangular, broader than long, without vestiture; femur with length slightly less than one half greatest width of capitulum, two thirds as broad as long, with four setae; genu two thirds as long as femur, one and one-half times as long as broad, sides subparallel, with four setae; tibia as long as genu, twice as long as broad, lateral margins subparallel, with one lanceolate, sensory seta one-half as long as width of segment, situated dorsally at about mid-segment, two normal and two long tactile setae; tarsus as long as tibia, two and one-half times as long as broad at base, tapering to narrow apex, with one lanceolate, annulated, sensory seta having length nearly equal to basal width of segment, located near inner margin at about apical third, three normal and four long, tactile setae; tarsus surmounted by short, narrow pretarsus with length about equal to basal width of tarsus, bearing at its apex a small empodium beyond which projects a stout, curved claw. Leg II with coxa robust, subquadrangular, one and one-fourth times as broad at base as long, lateral margins convex, segment without setae; femur one and one-third times as long as genu I, one and one-fourth times as long as greatest breadth, with three setae; genu subquadrate, two thirds as long as femur, with three setae; tibia as long as genu, one and one-third times as long as broad, sides subparallel, with four setae; tarsus as long as tibia, twice as long as broad at base, tapering to broadly rounded apex, with one ovate, annulated seta having length slightly less than basal width of segment, located dorsally near outer margin at base, one short, peglike seta as long as apical width of segment, located near inner margin at apex, two normal and one long, tactile setae; tarsus surmounted by a short pretarsus with length equal to two thirds basal width of tarsus, bearing at its apex two strong, curved, spreading claws between which projects a broad empodium. Leg III with coxa

subtriangular, slightly longer than femur II, without vestiture; femur as long as tibia I, inner margin nearly twice as long as outer margin, width at apex about one half length of segment, with one ventral seta; genu two thirds as long as femur, one and one-fourth times as long as broad, sides subparallel, three setae present on segment; tibia one and one-fifth times as long as genu, one and one-half times as long as broad, lateral margins subparallel, with four setae; tarsus nearly as long as tibia, twice as long as broad at base, tapering from base to narrowly rounded apex, with one tactile seta and four normal setae; tarsus surmounted by a short, narrow pretarsus with length equal to two thirds basal width of tarsus, bearing at its apex two large, curved, spreading claws between and beyond which extends a broad, bilobed empodium. Leg IV with coxa subtriangular, one and one-third times as broad as long, with one seta; femur nearly as long as leg I, one third as broad at base as long, tapering from base to apical third, of uniform width distad from this point, outer margin slightly convex, inner margin convex at basal fifth remainder concave, with one dorsal seta two thirds as long as segment located near outer margin at apical third, one ventral seta with length equal to two thirds basal width of segment situated at mid-point on inner margin, one ventral seta slightly less than one half as long as segment located near inner margin one fourth length of seta from apex; tibia with length equal to three fourths width of femur at apex, inner margin slightly concave, two thirds as long as convex outer margin, with one lanceolate, annulated seta situated dorsally near outer margin at apical fourth, one stout, tactile seta nearly three times as long as segment located ventrally near mid-segment at apical third; tarsus small, slightly less than one half as long as tibia, about twice as broad as long, with one dorsal seta three times as long as segment located near inner margin at apex, one dorsal seta slightly longer than segment located near outer margin at apex, one ventral seta with length equal to two thirds width of segment situated near inner margin at mid-segment; tarsus surmounted by a short, broad, curved claw with length equal to width of tarsus, width at base about one half its length. *Genital papilla*: Length, 26 μ ; width, 29 μ ; subcordate with anterior margin emarginate, posterior margin broadly truncate. *Measurements*: Overall length from tips of projecting palpi to apex of genital papilla, 184 μ ; anterior margin of cephalothoracic shield to main body suture, 47 μ ; main body suture to apex of genital papilla, 100 μ ; width of body at main body suture, 78 μ ; width of body at coxae III, 113 μ .

Female: Body short, oval, broadest at mid-length. Anterior apodemes well defined, those of legs I with length equal to width of tibia II, extending from innermost angles of coxae II to median apodeme, converging medially at nearly a right angle to the latter. Apodemes II subparallel to apodemes I, two and one-half times as long as the latter, their posterior extremities slightly incurved and separated from median apodeme by a distance equal to half their lengths. Anterior median apodeme extending conspicuously from Y-shaped juncture of apodemes I to a point in line with medial extremities of apodemes II, continuing obscurely to main body suture. Apodemes III as long as genu I, extending in nearly transverse directions from anterior condyles of coxae III, apodemes terminating medially at points on first hysterosomal suture slightly less than half the distance from anterior condyles of coxae III to median apodeme. Apodemes IV two thirds as long as coxae III, extending in anteromedial directions from points the width of coxa III mesad from inner margins of coxae III at their posterior thirds to point of convergence on median apodeme slightly behind first hysterosomal suture, apodemes with a small, knoblike thickening at their mid-lengths. Posterior median apodeme extending from point in line with posterior extremities of apodemes IV to a point just anterior to first hysterosomal suture, dividing at this point, each arm of the Y-shaped anterior extremity of apodeme as long as basal width of tibiotarsus I and forming nearly a right angle with one another. Four distinct hysterosomal sutures transecting body, one near anterior extremities of coxae III, one at anterior extremities of coxae IV, one midway between second suture and apex of body and one three fourths the distance from third suture to apex. Pseudostigmatic organs one and one-third times as long as tibia II, broadly oval, expanded apex slightly longer than narrow pedicel, diameter of basal ring slightly less than greatest breadth of expanded apex. Stigmatal openings situated slightly behind and laterad from first pair of dorsal propodosomal setae; tracheae clearly visible, extending posteromedially from stigmatal openings and intersecting medially at a point the length of apodemes I behind anterior extremity of anterior median apodeme, continuing less distinctly caudad from this point, tracheal pouches absent. Propodosoma projected dorsally beyond stigmatal openings to form a broadly rounded cephalothoracic shield which overlays basal portion of capitulum, apex of shield extending almost to bases of palpi. *Dorsal chaetotaxy:* Propodosoma with two pairs of dorsal setae; first pair as long as combined lengths of tibia and tarsus II, situ-

ated near lateral margins of cephalothoracic shield, four fifths length of seta from apex of shield; setae of second pair as long as combined lengths of genu and tibiotarsus I, located one fourth length of seta behind and slightly laterad from basal rings of pseudostigmatic organs. Hysterosoma with six pairs of dorsal setae; first pair as long as combined lengths of genu and tibia II, situated on lateral margins of body just behind main body suture; second pair of setae slightly shorter than first pair, located the length of seta from lateral margins of body in line with point slightly anterior to mid-lengths of coxae III; third pair of dorsal hysterosomal setae as long as tibia II, situated the length of seta laterad from posterolateral angles of coxae IV; fourth pair of setae with length subequal to third pair, situated on lateral margins of body half length of seta anterior to penultimate hysterosomal suture; fifth pair of setae slightly longer than setae of fourth pair, located in line with the latter and separated from each other by a distance equal to one and one-third times length of seta; sixth pair of setae as long as fifth pair, located on penultimate segment half length of seta from lateral margins of body, four fifths length of seta from caudal margin of segment. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair as long as genu II, located one half length of seta laterad from anterior extremity of median apodeme; second pair of setae as long as tibia II, situated on apodemes II at their anterior thirds. Hysterosoma with two pairs of ventral setae; first pair as long as genu II, located two thirds length of seta antero-medial from mesal extremities of apodemes III; setae of second pair subequal in length to setae of first pair, situated at caudal extremities of apodemes IV. *Capitulum*: Subcordate, with posterior margin broad, truncate; length not including palpi, 32μ ; length including extended palpi, 50μ ; greatest width, 32μ . Dorsal setae two thirds as long as tibiotarsus I, situated in line with bases of palpi, separated from each other by a distance equal to one half length of seta. Ventral setae slightly longer than dorsal setae, projecting forward nearly as far as palpi, located nearly opposite dorsal setae but slightly more approximate. Palpi three-segmented, basal segment short, its length equal to basal width of tarsus II, about one and one-half times as long as broad; second segment one and one-half times as long as first segment, about twice as long as broad; third segment slightly longer than second, slightly tapering to broadly rounded apex, the apex adorned with numerous tubercles and two short setae. Chelicerae elongate, styliform, projecting forward as far as palpi; cheliceral sheaths prominent,

with numerous, minute, transverse striae. *Legs:* Anterior pairs short and stout. Leg I with coxa subtriangular, as broad at base as long, without setae; femur with length about two thirds greatest width of capitulum, one and one-half times as long as broad at base, tapering slightly to apex, with three setae; genu about two thirds as long as femur, one and one-fourth times as long as broad at base, tapering slightly toward apex, with four setae; tibiotarsus about one and one-third times as long as femur, nearly four times as long as broad at base, lateral margins converging beyond distal third of segment to broadly rounded apex, with one long, tactile seta slightly longer than segment located middorsally at base, one minute, clavate, annulated seta with length equal to one fourth basal width of segment situated dorsally on outer margin twice length of seta from base, one seta two fifths as long as segment located dorsally near inner margin at basal third, one stout seta two fifths as long as segment located dorsally near inner margin at apical fourth, one dorsal seta with length slightly more than one third length of segment located near outer margin at apex, one ventral seta one fourth as long as segment located near outer margin at basal third, one ventral seta two thirds as long as segment located near inner margin at basal third, one ventral seta one half as long as segment situated on inner margin at basal third, one ventral seta one third as long as segment located on inner margin at apical third, one lanceolate, annulated seta having length equal to two thirds basal width of segment situated ventrally on outer margin at apical third, one stout, curved seta one third as long as segment located on outer margin at apex, one stout, curved seta one third as long as segment located on inner margin at apex; tibiotarsus surmounted by a short pretarsus, length equal to one half basal width of tibiotarsus, bearing at its apex a broad empodium beyond which extends a stout, curved claw. Leg II with coxa subquadrangular, slightly broader than long, without vestiture; femur three fourths as long as femur I, as broad as long, with three setae; genu one half as long as femur, one and one-third times as broad at base as long, tapering slightly toward apex, with two setae; tibia as long as basal width of genu, sides subparallel, with three setae; tarsus one and one-half times as long as genu, tapering from mid-length to broadly rounded apex, with one clavate, annulated seta having length equal to two thirds basal width of segment situated dorsally near outer margin at base, one seta two thirds as long as segment located middorsally at basal third, one seta one and one-fourth times as long as segment located on outer margin at apical third,

one seta one half as long as segment located on inner margin at mid-segment, one seta two thirds as long as segment located ventrally near inner margin at mid-segment; tarsus surmounted by a narrow pretarsus, length equal to basal width of tarsus, bearing at its tip a broad empodium and two large, spreading, curved claws. Leg III with coxa narrow, elongate, length equal to combined lengths of genu, tibia and tarsus II, greatest width equal to one third length, lateral margins convex for most of their lengths, segment without vestiture; femur as long as combined lengths of genu and tibia II, lateral margins diverging from basal two fifths to apex, outer margin sharply convex at proximal two fifths making segment bulbous basally, segment with three setae; tibia as long as femur, twice as long as broad at base, tapering toward apex, with four setae; tarsus slender elongate, two thirds as long as tibia, sides subparallel, with three setae; tarsus surmounted by a narrow pretarsus, one fourth as long as tarsus, bearing at its tip two large, spreading, curved claws between which projects a broad subcircular empodium. Leg IV with coxa small, subquadrangular, one and one-half times as broad as long, without setae; trochanter short, ringlike, broader than long, without vestiture; third segment narrow, elongate, as long as femur III, about four times as long as broad, sides subparallel, with one ventral seta slightly less than one half as long as segment located near outer margin the width of segment from base, one ventral seta three fifths as long as segment situated near outer margin one third length of seta from apex; fourth segment two fifths as long as third segment, lateral margins tapering slightly to broadly rounded apex, with one stout seta three times as long as segment located dorsally near outer margin at apical third, one terminal seta with length equal to combined lengths of femur and tibia III. *Measurements:* Anterior margin of cephalothoracic shield to apex of hysterosoma, 182 μ ; main body suture to tip of hysterosoma, 105 μ ; tips of palpi to main body suture, 103 μ ; width of body at anterior extremities of coxae III, 106 μ ; width at main body suture, 97 μ .

Holotype: Male, Woodside, San Mateo Co., Calif., June 2, 1949. R. E. Beer, *Quercus lobata* infested with *Asterolecanium minus*.

Allotype: Female, Domoto's Nursery, Hayward, Calif., Sept. 22, 1949, R. E. Beer, *Hydrangea quercifolia*.

Paratypes: Santa Paula, Calif., June 28, 1939, E. W. Baker, lemon bud, (plesiotype male); four males, four females and three larvae (morphotypes) same data as allotype; one female, Santa Paula,

Calif., Apr. 25, 1939, E. W. Baker, lemon fruit; one male, Santa Paula, Calif., May 16, 1939, E. W. Baker, lemon fruit; two males, Santa Paula, Calif., June 9, 1939, E. W. Baker, lemon; one male, Domoto's Nursery, Hayward, Calif., Aug. 17, 1949, R. E. Beer, *Hydrangea quercifolia*; one female, Domoto's Nursery, Hayward, Calif., Sept. 26, 1949, R. E. Beer, under bark of *Hydrangea quercifolia*.

Location of types: Holotype, allotype and two males, two females, three morphotypes with same data as allotype, one male from Santa Paula, June 9, 1939, and male from Domoto's Nursery, Sept. 26, 1949, deposited in the Snow Entomological Museum, University of Kansas. All other paratypes in the United States National Museum.

Living specimens of both sexes of this species are jet black in color, a character from which the trivial name is taken. Immature forms as well as young males and females are opaque white with a slight greenish tinge. The species is apparently fungivorous for it was reared through several generations in a container provided with fungus and algae which provided the only source of nourishment for the mites. Specimens collected by this writer were never very abundant. All stages, including eggs, were found in the collection made from under the bark of *Hydrangea quercifolia*.

Genus *Steneotarsonemus*, new genus

This genus is established to include a number of species with considerable similarity in general appearance but rather extensive diversity in specific characters. The males with one exception all have the dorsal propodosomal setae in linear arrangement, the usual number being four pairs; femora IV usually have the inner margins highly modified to form a flangelike process, never with a spurlike projection; the capitulum is usually subcircular, often as broad as or broader than long, never with extremely long palpi. Females never with a conspicuous transverse apodeme near main body suture; body often elongate, with anterior pairs of legs widely separated from posterior pairs; capitulum, as in male, usually as broad as or broader than long; first pair of ventral propodosomal setae usually in front of apodemes I; tracheae often with large conspicuous bilobed pouches or atria situated medially between legs I and II.

Type of genus: *Steneotarsonemus hyaleos*, new species.

In regrouping the mites of the family Tarsonemidae it became evident almost at the onset that a number of species were possessed

of an extraordinary resemblance. The most striking feature appeared to be the presence of a highly specialized femur in the males and the common occurrence of an exceptionally elongate body in the females. The members of this genus are all phytophagous and it is remarkable to note in this connection that with the exception of *S. pallidus*, *S. chionaspivorus* and *S. fulgens* the host plants are invariably Monocotyledonae. Within the genus there appears to be some natural grouping, based upon morphological characters, which is again reinforced with host preference. The group including *S. hyaleos*, *S. phyllophorus*, *S. spirifex*, and *S. bancrofti* all feed on plants of the family Gramineae and all bear a very close morphological resemblance. *S. latipes* appears to belong to this group, but the only clue to the feeding habits of this species suggests banana as a host which is in the family Musaceae. *S. laticeps* and *S. ananas* are dissimilar in many respects to the species mentioned above, the hosts of these two being narcissus (Amaryllidaceae) and pineapple (Bromeliaceae), respectively. *S. pallidus* and *S. fulgens* appear to bear the least morphological similarity to other species in the genus. The wide host range of *S. pallidus* and the extraordinary fact that it apparently never feeds on plants in the Monocotyledonae further segregates this species from other members. Biological data on *S. fulgens* is limited due to the fact that at present it is known only from a single collection. *S. chionaspivorus*, it is presumed from collection data available, is apparently the only fungivorous species in the genus.

KEY TO THE MALES OF THE GENUS STENEOTARSONEMUS

1. Femur IV with inner margin produced to form a flangelike expansion 2
 Femur IV without an inner flange..... 9
2. Propodosoma with four pairs of dorsal setae..... 3
 Propodosoma with but three pairs of dorsal setae (the setae of second pair missing)..... *phyllophorus*, p. 1244
3. Fourth dorsal propodosomal setae longer than setae of other three pairs; coxae III densely punctate over most of surface . . . *hyaleos*, p. 1256
 Fourth dorsal propodosomals never longer than setae of other pairs; coxae III never ornamented..... 4
4. First dorsal propodosomal setae longer than setae of other three pairs; capitulum and legs IV very small compared to large size of idiosoma *bancrofti*, p. 1249
 First dorsal propodosomals never longer than remaining three pairs; capitulum and legs IV not disproportionately small compared to dimensions of idiosoma..... 5

5. First dorsal propodosomal setae shorter than setae of remaining three pairs *ananas*, p. 1276
First dorsal propodosomals never the shortest of the dorsal propodosomal setae 6
6. Second dorsal propodosomal setae conspicuously shorter than setae of remaining three pairs 7
Second dorsal propodosomals nearly as long or longer than other dorsal propodosomals 8
7. Femur IV with inner flange small and somewhat angulate; first ventral propodosomal setae inserted very close to apodemes I; very small mites *latipes*, p. 1238
Femur IV with large lobelike inner flange; first ventral propodosomal setae situated well behind apodemes I; mites of moderate size *spirifex*, p. 1261
8. Tactile seta of tibia IV longer than femur IV; fourth dorsal propodosomal setae shorter than setae of remaining three pairs and not in linear arrangement with the others *pallidus*, p. 1267
Tactile seta of tibia IV shorter than femur IV; fourth dorsal propodosomals with length subequal to second setae and only slightly shorter than setae of first pair, all setae in linear arrangement, *fulgens*, p. 1281
9. Tactile seta of tibia IV very short, scarcely longer than segment; longest dorsal propodosomal setae (third) as long as two thirds greatest width of capitulum *laticeps*, p. 1231
Tactile seta of tibia IV nearly as long as leg IV; longest dorsal propodosomal setae (third) with length nearly twice greatest width of capitulum *chionaspivorus*, p. 1285

Steneotarsonemus laticeps (Halbert), new combination

(Plates 6, 18 and 22)

Tarsonemus laticeps Halbert, 1923, Jour. Linn. Soc. London, Zool., vol. 35, p. 381; Breakey, 1943, Washington Agr. Exp. Sta. Bull., 435, p. 116; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 15.

Tarsonemus approximatus narcissi Ewing, 1929, Proc. Ent. Soc. Washington, vol. 31, no. 2, p. 31; Massee, 1933, Ann. Mag. Nat. Hist., London, vol. 10, no. 11, p. 198; Smith, 1935, Jour. Econ. Ent., vol. 28, no. 1, p. 91; Doucette, 1936, Jour. Econ. Ent., vol. 29, no. 6, p. 1103.

Tarsonemus hydrocephalus Vitzthum, 1929, Ent. Tidskr., vol. 50, no. 2, p. 97.

Male: Body short oval, broadest at mid-length; legs short, stout, anterior pairs subequal; apodemes conspicuous; hysterosomal suture distinct, transecting body between coxae III and IV; genital papilla broad, with two apical spinelike processes projecting laterad from apex a distance nearly equal to half width of papilla. Apodemes I as long as width of femur I, extending in posteromedial directions from inner angles of coxae I converging medially slightly behind inner coxal angles of legs I. Anterior median apodeme ex-

tending from point of juncture of apodemes I nearly to main body suture, being less distinct posterior from its mid-length. Apodemes II subparallel to apodemes I, extending in posteromedial directions from inner angles of coxae II turning sharply caudad just before juncture with median apodeme, converging on median apodeme less abruptly beyond this point, the point of juncture being just before main body suture. Apodemes III extending in anteromedial directions from anterior condyles of coxae III joining with anterior extremities of apodemes IV, the apodemes defining an area broadly rounded anteriorly, anterior extremities of areas about one fourth distance from main body suture to hysterosomal suture. Apodemes IV strong and distinct, extending from basal angles of coxae IV converging gradually with apodemes III. Posterior median apodeme extending medially from a point just behind posterior extremities of interapodemal areas nearly to hysterosomal suture, apodeme most distinct from mid-length to posterior extremity. Cephalothoracic shield projecting over basal third of capitulum, its anterior margin truncate, as broad as capitulum. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae arranged in two longitudinal rows paralleling body margins, the setae of each row being nearly equidistant from each other; setae of first pair as long as combined lengths of tibia and tarsus II, located the length of seta behind anterior margin of cephalothoracic shield, one half length of seta from lateral margins of body, setae of pair separated from each other by a distance slightly greater than their combined lengths; second pair of setae slightly longer than first pair, located four fifths length of seta behind setae of first pair, slightly less than half length of seta from lateral margins of body; third pair of setae nearly three times length of first pair, situated the length of first seta behind second seta, three fourths length of first seta from lateral margins of body; fourth pair of setae very stout, nearly half as long as setae of third pair, located slightly more than one third length of seta behind setae of third pair, about half length of seta from lateral margins of body. Hysterosoma with four pairs of dorsal setae, third pair longer than the others. *Ventral chaetotaxy*: Propodosoma with two pairs of small setae; first pair as long as basal width of tarsus I, located the length of seta laterad from anterior extremity of median apodeme; second pair of setae slightly longer than first pair, located about twice length of seta behind mid-lengths of apodemes II. Hysterosoma with two pairs of ventral setae; first pair as long as tibia III, located near intersections of apodemes III and IV, this location being slightly more than twice length of seta behind main

body suture; second pair of ventral hysterosomal setae two thirds length of first pair, located the length of seta laterad from apodemes IV, about in line with anterior extremities of coxae III. *Capitulum*: Length including chelicerae, 39μ ; greatest width, 35μ ; subcircular, posterior margin rounded with small median indentation. Dorsal setae with length equal to half greatest width of capitulum, located on margins at apical fourth. Ventral setae about one third as long as dorsal setae, separated from each other by distance equal to one and one-half times length of seta. Palpi stout, indistinctly segmented, projecting slightly beyond apex of capitulum. Chelicerae prominent, projecting beyond extremities of palpi; cheliceral sheaths not striate. *Legs*: Leg I with coxa subquadrangular, nearly twice as broad as long, without vestiture; femur as broad as long, tapering from base to apex, with four setae; genu as broad as long, three fourths as long as femur, lateral margins subparallel, with four setae; tibia slightly longer than genu, one and one-fourth times as long as broad at base, tapering from mid-segment to apex, with four normal setae, one tactile seta and two specialized sensory setae, the latter including one short, clavate seta with length equal to one third basal width of segment located dorsally near outer margin at basal third and one rodlike seta with length equal to one third basal width of segment located ventrally on outer margin at basal third; tarsus surmounted by broad empodium beyond which projects tip of strong, curved claw. Leg II with coxa subquadrangular, nearly twice as broad as long, without setae; femur short and broad, slightly longer than greatest breadth, tapered from base to apex, outer margin twice as long as inner margin, with three setae; genu one and one-fourth times as broad as long, tapering slightly from base to apex, with three setae; tibia slightly longer than genu, as broad as long, with four setae; tarsus slightly shorter than tibia, width at base slightly less than length of segment, with four long tactile setae, one stout spine located dorsally near outer margin at basal third, one peglike seta located dorsally near inner margin at basal third and one stout, blunt spine located mid-ventrally just before apex; tarsus surmounted by short broad pretarsus bearing at its apex two stout, curved, spreading claws between and beyond which extends broad, bilobed empodium. Leg III with coxa subtriangular, as long as combined lengths of femur and genu II, posterolateral angle projecting beyond body margin, without vestiture; femur two thirds as long as coxa, twice as long as broad at apex, tapering from base to apex, with one seta; genu as broad as long, with three setae; tibia one and one-third times as long as genu,

tapering from distal third to apex, with one broad spine having length equal to one half apical width of segment located dorsally near outer margin at apical third and three tactile setae; tarsus two thirds as long as tibia, one and one-half times as long as broad at base, tapering from base to broadly rounded apex, with three normal setae, one broad spine with length equal to three fourths basal width of segment located ventrally near outer margin at apex and one short, spinelike seta with length equal to half basal width of segment located on outer margin at apex; tarsus surmounted by short, broad pretarsus bearing at its apex two strong, curved, spreading claws between and beyond which projects broad, bilobed empodium. Leg IV with coxa subquadrangular, about one and one-half times as broad as long, outer margin twice as long as inner margin, with one seta; femur short, broad, with length about equal to combined lengths of femur, genu and tibia of leg III, greatest width about equal to half length of segment, inner margin straight for most of its length, outer margin convex, with three setae; tibia as long as tarsus III, outer margin twice as long as inner margin, the latter concave, segment with one rodlike seta two thirds as long as segment situated dorsally on outer margin just before apex and one ventral tactile seta one and one-fourth times as long as segment; tarsus small, about one fourth as long as tibia, twice as broad as long, with three setae; tarsus surmounted by short, broad, slightly curved claw as long as width of tarsus with small notch in outer margin at basal fourth. *Genital papilla*: Length, 33 μ ; width, 40 μ ; anterior margin in line with hysterosomal suture, deeply emarginate medially; with two conspicuous, broad, dorsal flaps extending laterally from caudal extremity of papilla, needlelike paired aedeagi with recurved bases in apical third of papilla, their terminal portions projecting laterad from apex of papilla a distance equal to greatest width of femur IV. *Measurements*: Length from tip of capitulum to apex of genital papilla, 183 μ ; main body suture to apex of genital papilla, 109 μ ; anterior margin of cephalothoracic shield to main body suture, 55 μ ; width at main body suture, 91 μ ; width midway between main body suture and coxae III, 97 μ .

Female: Body elongate oval, broadest at point in line with posterior margins of coxae III. Anterior apodemes distinct; posterior apodemes short and inconspicuous. Apodemes I as long as basal width of genu I, converging medially at anterior extremity of median apodeme, their forward extremities at inner coxal angles of legs I. Apodemes II subparallel to apodemes I, extending from inner coxal

angles of legs II in posteromedial direction, converging with median apodeme in line with posterior margins of coxae II; apodemes indistinct for a short distance before juncture with median apodeme. Anterior median apodeme well defined from Y-shaped juncture of apodemes I nearly to juncture of apodemes II, disappearing midway between juncture of apodemes II and main body suture. Apodemes III extending medially from anterior condyles of coxae III at nearly right angles to inner margins of coxae, length equal to one third length of coxa III, terminating indistinctly. Apodemes IV inconspicuous, extending anteromedially from points the basal width of tarsus II mesad from inner margins of coxae III at their posterior fourth to points about in line with mid-coxae, these anterior extremities of apodemes III indistinct but separated from median apodeme by distance equal to basal width of tarsus II. Posterior median apodeme indistinct, extending from point in line with anterior extremities of coxae IV to point in line with anterior extremities of apodemes IV. Hysterosoma with six transverse sutures. Cephalothoracic shield short, truncate covering basal fourth of capitulum. Pseudostigmatic organs as long as femur I, expanded apex broadly oval with acute tip, pedicel slender, two thirds as long as expanded apex; basal rings situated midway between coxae I and II. Stigmatal openings distinct, located dorsolaterally the basal width of tibiotarsus I behind anterolateral angles of cephalothoracic shield. *Dorsal chaetotaxy*: Propodosoma with two pairs of dorsal setae; first pair nearly as long as pseudostigmatic organs, located one third length of seta mesad from anterolateral angles of cephalothoracic shield; second pair of setae slightly longer than half width of body at main body suture, located immediately behind pseudostigmatic organs. Hysterosoma with six pairs of dorsal setae all about equal in length, as long as greatest width of coxa III; first pair located on lateral margins of body the length of seta behind main body suture; second pair located three fourths length of seta behind main body suture, twice length of seta from lateral margins of body; third pair in line with anterolateral coxal condyles of legs IV, twice length of seta from lateral margins of body; fourth pair situated on lateral margins of body near anterior margin of penultimate segment; fifth pair of setae nearly in line with fourth pair, separated from each other by distance equal to twice length of seta; sixth pair of dorsal hysterosomal setae located on caudolateral margins of body near base of apical segment. *Ventral chaetotaxy*: Propodosoma with two pairs of minute setae; first pair with length equal to one third basal width of tibiotarsus I, situated slightly be-

hind apodemes I at their mid-lengths; setae of second pair about one and one-half times as long as first pair, located the length of seta behind apodemes II at their mid-lengths. Hysterosoma with first pair of ventral setae slender, elongate, with length equal to greatest width of coxa III, located nearly twice length of seta from main body suture, separated from each other by distance slightly less than their combined lengths; second pair one half length of first pair, situated at posterior extremities of apodemes IV. *Capitulum*: Short and broad; length including palpi, 40μ ; greatest width, 43μ ; posterior margin rounded truncate with a very small emarginate cleft medially. Dorsal setae with length nearly equal to half greatest width of capitulum, located near lateral margins of capitulum at anterior fifth; ventral setae one third as long as dorsal setae, separated from each other by a distance equal to combined lengths; palpi short, stout, indistinctly segmented. Chelicerae styliform, expanded basally, needlelike apices extending slightly beyond tips of palpi. *Legs*: Anterior pairs short and broad. Leg I with coxa subtriangular, one and one-half times as broad as long, without setae; femur robust, width at base equal to length, tapering from base to apex, with four normal setae; genu two thirds as long as femur, slightly longer than broad at base, tapering from base to apex, with four setae; tibiotarsus one and one-half times as long as genu, tapering to broadly rounded apex, with three modified setae located dorsally on basal fourth of segment, the outermost lanceolate with length equal to half basal width of segment, middle seta of trio capitate with its expanded apical half pitted, length slightly greater than the lanceolate seta, innermost seta located medially on segment peglike, slightly shorter than lanceolate seta, one clavate seta with length equal to half basal width of segment located dorsally near inner margin at apical third, one short, stout, peglike process with lateral margins concave and length equal to one third basal width of segment located mid-ventrally at apex, twelve normal setae; tibiotarsus surmounted by short, narrow pretarsus bearing a broad empodium beyond which projects tip of small curved claw. Leg II with coxa subquadrangular, nearly one and one-half times as broad as long, without vestiture; femur as long as greatest breadth, tapering slightly from base to apex, with three setae; genu slightly broader at base than long, tapering slightly from base to apex, with three setae; tibia slightly longer than broad, as long as genu, lateral margins subparallel, segment with four setae; tarsus nearly as long as tibia, tapering from base to broadly rounded apex, with one

short, broad, stout spine with length about one third basal width of segment situated dorsally near inner margin at basal fifth of segment, one clavate seta with length equal to half basal width of segment located dorsally on inner margin at basal fifth, one stout, curved, apical, clawlike spur on outer margin at apical third of segment with length equal to one third length of segment and four normal setae; tarsus surmounted by short pretarsus bearing a pair of short, spreading, curved claws between and beyond which projects a broad empodium. Leg III with coxa narrow, elongate, as long as femur and tibia combined, nearly four times as long as greatest breadth, without vestiture; femur nearly two thirds as long as coxa, basal fourth expanded bulbous, segment with lateral margins divergent from basal third to apex, four setae on segment; fibia three fourths as long as femur, one and one-half times as long as broad at base, lateral margins slightly convex and converging from base to apex, segment with four widely separated setae; tarsus two thirds as long as tibia, nearly twice as long as broad at base, tapering from base to broadly rounded apex, with four setae all situated on apical half of segment and with a short, stout, mid-ventral spur just before apex; tarsus surmounted by a short, broad pretarsus bearing at its apex a pair of stout, curved, spreading claws between and beyond which projects broad empodium. Leg IV with coxa small, subtriangular, nearly one and one-half times as broad as long, without setae; trochanter collarlike, one and one-half times as broad as long, without setae; third segment subcylindrical, tapering slightly from base to mid-segment, sides subparallel from this point to apex, length of segment nearly equal to combined lengths of tibia and tarsus III, with one seta one third as long as segment located ventrally near outer margin one fifth length of seta from base of segment, one stout seta nearly half as long as segment located mid-ventrally slightly less than half length of seta before apex; fourth segment slightly less than half as long as third segment, about three times as long as broad at base, with one stout seta one and one-half times as long as segment located ventrally at apical third of segment, one terminal seta nearly one and one-half times as long as leg IV. *Measurements:* Apex of cephalothoracic shield to tip of opisthosoma, 227 μ ; tip of shield to main body suture, 82 μ ; width at main body suture, 98 μ ; width at anterior condyles of coxae III, 112 μ ; distance between anterior condyles of coxae III, 68 μ .

Types: County Dublin, Ireland, January, abundant in partly decayed narcissus bulbs.

Location of types: Irish National Museum (?).

Material examined by the present writer included specimens with the following data: Males and females, Natividad, Calif., Jan. 28, 1926 and Feb. 6, 1926, C. F. Doucette, narcissus (bearing type labels no. 960 of *T. approximatus narcissi*); San Leandro, Calif., Feb. 6, 1926, C. F. Doucette, narcissus (bearing type label no. 960 of *T. approximatus narcissi*); Bellingham, Wash., Sept. 18, 1928, David Griffiths, narcissus (bearing type label no. 960 of *T. approximatus narcissi*); Castle Hayne, N. C., Jan. 30, 1932, J. T. Sondey, narcissus; Sumner, Wash., Apr. 15, 1933, C. F. Doucette, from *Hippeastrum* in greenhouse; Waterford, Ireland (at Hoboken), Oct. 15, 1942, Limber, narcissus bulbs; Broughshane, Ireland (at Hoboken), Sept. 25, 1942, Limber, on narcissus bulb; Broughshane, Ireland (at Hoboken), Sept. 29, 1942, Limber, on narcissus bulbs; Waterford, Ireland (at Hoboken), Sept. 11, 1922, Limber, narcissus bulbs; Waterford, Ireland (at Hoboken), Sept. 19, 1926, Limber, narcissus bulbs.

This species is one of the two species that are unique as members of the genus as presently constituted in that the male lacks a femoral flangelike expansion on leg IV. However, a consideration of other morphological characters in both sexes has led this author to conclude that *S. laticeps* undoubtedly belongs with this group.

Ewing (1939) presents good evidence in support of the synonymy of *T. approximatus narcissi* Ewing and *T. hydrocephalus* Vitzthum and the present author concurs in the conclusions drawn in the reference cited.

S. laticeps is obviously a plant feeder as it has been repeatedly and reliably reported as damaging narcissus bulbs as well as bulbs of other plants in the family Amaryllidaceae. The present writer has collected tarsonemid mites frequently on narcissus bulbs, but in every instance the specimens taken have been *T. setifer*.

Stencotarsonemus latipes (Ewing) new combination

(Plates 7, 18, and 22)

Tarsonemus latipes Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 46.

Male: Body short, oval, broadest at anterior condyles of coxae III; legs short, stout, second pair slightly larger than legs I; apodemes conspicuous, well defined; hysterosomal suture distinct. Apodemes I with length equal to half greatest width of capitulum, forming a Y-shaped acute angle at the point of intersection with anterior extremity of anterior median apodeme. Apodemes II extend-

ing from inner angles of coxae II in posteromedial directions for a distance equal to greatest width of capitulum, curving slightly caudad at this point and terminating slightly anterior to main body suture, separated at their posterior extremities by a distance equal to basal width of tarsus I. Anterior median apodeme extending from Y-shaped juncture of apodemes I almost to main body suture, becoming indistinct posterior to point in line with inner coxal condyles of legs II. Apodemes III extending from anterior condyles of coxae III in anteromedial directions curving abruptly inward at points one half the distance between their posterior extremities and main body suture, intersecting median apodeme indistinctly. Apodemes IV subparallel to posterior portions of apodemes III, extending from anterior condyles of coxae IV to points of intersection with transverse continuations of apodemes III, the points of intersection slightly laterad from median apodeme, apodemes strongly sclerotized in caudal two thirds of their lengths, weak and indistinct in anterior thirds. Posterior median apodeme extending from juncture with apodemes III to point slightly anterior to inner coxal condyles of legs IV, apodeme strongly sclerotized for the posterior half of its length, indistinct anteriorly. Cephalothoracic shield covering basal half of capitulum its anterior margin truncate, equal to width of capitulum. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae in linear arrangement, setae of third pair longer than others, setae of second pair shorter than others, first and fourth pairs subequal in length. Hysterosoma with four pairs of dorsal setae. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair located on apodemes I at about their mid-lengths; second pair situated near center of area defined by apodemes II, main body suture and lateral margins of body. Hysterosoma with two pairs of ventral setae; first pair situated near apodemes III at anterior third of apodemes; second pair located on apodemes IV at their posterior thirds. *Capitulum*: Narrow, subcordate with posterior margin emarginate. Dorsal setae with length equal to one third greatest width of capitulum, situated near lateral margins at about mid-length of capsule. Ventral setae slightly longer than dorsal setae, situated at apical fourth of capitulum. Palpi indistinctly segmented, projecting slightly beyond apex of capsule, enclosing short, styliform chelicerae. Length of capitulum including projecting palpi, 21 μ ; greatest width, 16 μ . *Legs*: Short, robust, tapering abruptly from base to apex; legs I and II subequal in size. Leg I with coxa subquadrangular, broader

than long, without vestiture; femur with outer margin slightly longer than basal width of segment, inner margin one third as long as outer margin, segment with two setae; genu short, sides converging toward apex, length of segment less than width at base, segment with four setae; tibia slightly longer than broad, sides subparallel and slightly convex, segment with one dorsal, peglike, annulated sensory seta near outer margin at mid-segment and four normal setae; tarsus short, tapering to broadly rounded apex, length equal to basal width, segment terminating ventrally in a stout spurlike process, one clavate, annulated sensory seta with length equal to two thirds basal width of segment, located dorsally near outer margin at basal third of segment, seven normal setae; tarsus terminates in short, narrow pretarsus bearing a broad empodium, nearly as long as tarsus beyond which projects tip of single weak claw. Leg II with coxa subquadrangular, broader than long, without setae; femur slightly longer than basal width, bearing two setae; genu shorter than broad at base, sides converging toward apex, with one stout spine near inner margin at base and three normal setae; tibia slightly longer than broad, sides subparallel, segment with four setae; tarsus as broad at base as long, tapering abruptly to narrowly rounded apex, a ventral spurlike projection on apical margin, segment with one large, clavate, annulated seta situated on inner margin at mid-segment, one short, robust, clavate, sensory peg located dorsally at mid-segment, three normal setae; tarsus surmounted by a slender elongate pretarsus bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa broad, subtriangular, sides strongly convex, segment one and one-half times as long as greatest breadth, without setae; femur with inner margin twice as long as outer, segment twice as long as broad, with two setae; genu as long as broad with three setae; tibia nearly one and one-half times as long as broad, with one short, stout, ventral spine near inner margin at mid-segment and three normal setae; tarsus slightly longer than broad at base, tapering abruptly from base to narrowly rounded apex, segment with a strong, ventral, clawlike projection and three setae; tarsus surmounted by short, narrow pretarsus bearing two strong, curved, spreading claws and a broad, bilobed empodium. Leg IV with coxa subtriangular, as broad at apex as long, with one ventral seta; femur short and broad nearly one and one-third times as long as broad at base, inner margin with angular flange occupying apical half of segment, three

short setae on segment; tibia narrow, elongate, about one and one-half times as long as broad, sensory seta clavate, tactile seta as long as femur and tibia combined; tarsus one half as long as tibia, broader than long, with three setae subequal in size; tarsus surmounted by short, broad, blunt, curved claw. *Genital papilla*: Length, 30 μ ; width, 21 μ ; subcordate with anterior margin emarginate, posterior margin broadly truncate. *Measurements*: Length from tips of palpi to apex of genital papilla, 132 μ ; anterior margin of cephalothoracic shield to main body suture, 35 μ ; width at anterior condyles of coxae III, 75 μ .

Female: Body slender, elongate, broadest at mid-length, sides subparallel from main body suture to coxae IV. Apodemes I as long as genu I, extending from inner angles of coxae I to anterior extremity of median apodeme, the anterior angle formed at point of convergence acute. Apodemes II slightly longer than and subparallel to apodemes I, extending from inner coxal angles of legs II almost to median apodeme. Anterior median apodeme extending from Y-shaped juncture of apodemes I to main body suture, most distinct at its anterior fourth and for a short distance near converging extremities of apodemes II. Apodemes III extending in anteromedial directions from anterior condyles of coxae III for a distance equal to two thirds length of coxa III, continuing beyond this point indistinctly. Apodemes IV slightly longer than and subparallel to apodemes III, their posterior extremities near anterolateral angles of coxae IV, anterior extremities near first hysterosomal suture and separated from each other at this point by a distance equal to one half basal width of tibiotarsus I. Posterior median apodeme indistinct. Hysterosoma with three conspicuous transverse sutures, one at anterior extremities of coxae III, one at coxae IV, one midway between coxae IV and apex of hysterosoma. Cephalothoracic shield with anterior margin truncate, width of margin equal to greatest width of capitulum. Pseudostigmatic organs with apices broadly oval, pedicels slightly shorter than length of expanded apex. Stigmatal openings distinct, situated dorsolaterally near anterolateral angles of cephalothoracic shield. *Dorsal chaetotaxy*: Propodosoma with two pairs of dorsal setae; first pair with length equal to one half length of tibiotarsus I, situated just behind anterolateral angles of cephalothoracic shield; setae of second pair with length equal to length of capitulum, located near posterolateral angles of propodosoma. Hysterosoma with five pairs of dorsal setae. *Ventral chaetotaxy*: Propodosoma

with two pairs of ventral setae; first pair with length equal to length of genu I, located on apodemes I just behind anterior extremities of apodemes; setae of second pair subequal in length to setae of first pair, situated just behind apodemes II at their anterior thirds. Hysterosoma with two pairs of ventral setae; first pair as long as tibiotarsus I, located near anterior extremities of apodemes III, the pair separated from each other by a distance slightly greater than length of seta; setae of second pair slightly shorter than setae of first pair, situated on apodemes IV at about mid-lengths of apodemes. *Capitulum*: Elongate, oval; length including projecting palpi, 23 μ ; greatest width, 16 μ ; posterior margin rounded truncate with slight medial emargination. Dorsal setae with length equal to one fourth width of capitulum, located near lateral margins at apical third of capsule. Ventral setae slightly longer than dorsal setae, situated in transverse line with dorsal setae. Palpi robust, indistinctly segmented with one short apical seta and one sub-apical seta on outer margin. *Legs*: Anterior pairs short and robust, subequal in size. Leg I with coxa subquadrangular, broader than long, without vestiture; femur robust, sides tapering toward apex, with three setae; genu slightly longer than broad, sides subparallel, segment with three setae; tibiotarsus two and one-half times as long as broad at base, sides subparallel for most of the length of segment, apex broadly rounded, segment with one short, stout, clavate, annulated seta and one slightly longer, peglike, sensory seta located dorsally near outer margin at basal third of segment, one long, clavate, annulated seta located dorsally near inner margin at apical third, two short, spinelike setae, three normal setae and two strong, curved, apical setae, segment with an apical clawlike spur located ventrally; tibiotarsus surmounted by a narrow pretarsus bearing at its apex a broad empodium beyond which projects tip of weak, curved claw. Leg II with coxa subquadrangular, broader than long, without setae; femur with length of outer margin equal to width of coxa, inner margin slightly less than half length of outer margin, segment with two setae; genu as broad at base as long, tapering slightly toward apex, with three setae; tibia as long as genu, one and one-half times as long as broad, sides subparallel, with three short and one long tactile setae; tarsus short, as broad at base as long, tapering abruptly to broadly rounded apex, segment with one long, clavate, annulated seta nearly as long as segment located dorsally near inner margin at mid-segment, one short, peglike, annulated seta located ventrally near inner margin at about

mid-segment, one long tactile seta and two short setae, tarsus bearing ventrally at its outer apical margin a short spurlike projection; tarsus surmounted by a short pretarsus bearing two small, curved claws between which projects a broad empodium. Leg III with coxa slender, elongate, as long as combined lengths of genu and tibiotarsus I, without vestiture; femur two thirds as long as coxa, basal third bulbous, apical two thirds of segment with sides diverging from constriction at basal third to broad apex, segment with three ventral and one dorsal setae; tibia as long as femur, lateral margins convex, with four setae; tarsus slender, elongate, two thirds as long as tibia, with two normal and one elongate tactile setae; tarsus surmounted by slender, elongate, bilobed pretarsus bearing at its apex two curved, spreading claws between and beyond which projects broad empodium. Leg IV as long as leg III, with coxa small, subquadrangular, as broad as long, without setae; trochanter small, one and one-half times as broad as long, without setae; third segment slender, elongate with sides subparallel for entire length, segment approximately eight times as long as broad, with one seta one sixth as long as segment located ventrally at base of segment, one seta as long as basal seta situated ventrally at apical sixth of segment; fourth segment two fifths as long as third segment, sides slightly divergent toward apex, with one short, stout, ventral seta slightly toward apex from mid-segment, its length equal to one and one-fourth times length of segment, one terminal seta one and one-half times the length of leg IV. *Measurements:* Apex of cephalothoracic shield to tip of opisthosoma, 126 μ ; tip of shield to main body suture, 52 μ ; width at main body suture, 49 μ .

Types: Material originating in Colombia, South America, intercepted at New York City, New York, Sept. 20, 1934, F. O. Dodd, in banana debris.

Location of types: U. S. National Museum. One male specimen from the cotype series, identified by U.S.N.M. No. 1133-A is hereby designated lectotype.

Specimens examined by the present writer included all mites in the type series including males and females taken by F. O. Dodd from an unidentified leaf in banana debris from Colombia, at New York City, on September 20, 1934. The type slide was broken down and the mites were mounted individually on separate slides. Critical examination of specimens indicates that Ewing's (1939) observation of a hyaline expansion on the outer margin of the male

tibiotarsus IV was in error, as such an expansion does not exist. Also, in the same reference, Ewing remarks on the unusual ventral placement of the subapical seta of the terminal segment in leg IV of the female. Such placement was found in the present study to be the usual position in all species studied. The most striking features of this species are here noted as the small size, as compared to other members of the genus, and the long, narrow capitulum.

Steneotarsonemus phyllophorus (Ewing), new combination

(Plates 4, 17 and 22)

Tarsonemus phyllophorus Ewing, 1924, Proc. Ent. Soc. Washington, vol. 26, no. 3, p. 66; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 47.

Male: Body short and broad, diamond-shaped, tapering abruptly to anterior and posterior from coxae III. Rostral shield truncate at apex. Main body suture distinct, transecting body between coxae II and anterior margins of apodemes III. Leg I apodemes short, length equal to width of genu I, converging with anterior median apodeme opposite bases of femora of legs I. Leg II apodemes distinct, converging on anterior median apodeme opposite middles of bases of coxae II, median apodeme decreasing in distinctness from this point to main body suture. Apodemes of legs III and IV converging anteriorly just behind main body suture, forming well defined areas which are sharply rounded anteromedially and broad at bases of coxae III. Posterior median apodeme indistinct except at its anterior extremity where it is visible as a three-tined fork, one medial tine, the other two diverging anteriorly, times subequal in length, as long as width of tarsus I, median apodeme becoming indistinct posterior to base of tines, this conspicuous portion of apodeme located medially in line with anterior condyles of coxae III, apodeme with two divergent forks just before apex of body each directed caudolaterally, terminating at inner apical angles of coxae IV. *Dorsal chaetotaxy:* Three pairs of setae on propodosoma; anterior pair small, length equal to width of tarsus I, located in line with anterior extremity of median apodeme the length of leg I apodeme laterad from mid-line; second setae quite long, tapering to threadlike tip, as long as leg I from base of femur to apex of tarsus, situated one half width of tarsus I from base of coxa II, in line with juncture of apodemes II and median apodeme, this pair of setae separated from each other by a distance equal to length of seta; third pair of setae long and broad, as wide for most of their lengths as basal diameter of second setae, length of setae equal to combined lengths of femur and genu I, situated half length of seta immediately

behind second setae and about one third length of seta in front of main body suture. Four pairs of setae on hysterosoma; anterior pair as long as distance from basal condyle of coxa III to main body suture, situated near lateral margins of body one half width of tibia I in front of basal condyles of coxae III; second pair of hysterosomal setae with length equal to half width of capitulum, situated on apodemes IV one third length of apodeme from its posterior extremity; third pair of hysterosomal setae about as long as first pair, located opposite inner margins of coxae IV, about one half seta length anterior to front margin of genital papilla and in line with lateral margins of papilla at its broadest point; fourth pair of setae slightly shorter than third pair, situated beside genital papilla in line with base of anterior cleft of papilla, one sixth width of papilla from its lateral margin. *Ventral chaetotaxy*: Four pairs of setae on venter of body, two pairs on propodosoma, two pairs on hysterosoma; first pair small, length equal to width of tarsus I, located seta length laterad from anterior extremity of median apodeme; second pair with length equal to length of tarsus I, one and one-half times length of seta from median apodeme in line with juncture of apodemes II and median apodeme; first pair of hysterosomal setae as long as width of femur II at apex, located midway between basal condyles of coxae III and mid-body in line with this condyle, in apical third of interapodemal area; second pair of hysterosomal setae of same length as first pair, situated close to apodemes IV at basal fourth of interapodemal area, this pair of setae thus being almost in line with juncture of three short forks of forward extremity of posterior median apodeme. *Capitulum*: Length including projecting palpi, 36 μ ; width, 36 μ ; cordate with posterior margin emarginate; a pair of ventral setae at bases of palpi; one pair of dorsolateral setae opposite bases of palpi; apical segment of palpus with minute subterminal bristle on outer margin. *Legs*: Anterior pair slightly longer than second pair, both pairs with five segments, front legs terminating in single claw, second pair with two claws, both with large empodia; coxae and genua of legs I and II broader than long, remaining segments longer than broad. Legs III very large, nearly as long as breadth of body at coxae III; coxae two thirds as broad at apex as long, the former dimension equal to length femur II; femur twice as long as broad, inner margin indented at mid-segment; genu broader than long; tibia almost twice as long as broad; tarsus tapering from base to apex, terminating in two strong claws and a broad empodium. Legs IV reduced in length, greatly expanded in breadth; coxa subquadrangular, broader than long,

with a single seta situated near mid-segment; femur twice as long as tibia III, with a broad, rounded, membranous inner expansion, extending from near apex of segment nearly four fifths its length, segment with three setae, one located near inner margin of femur proper, one third length of segment from apex, seta as long as genu III, another seta with size subequal to former, situated on inner margin of femur proper at base of femoral flange, remaining seta on outer margin of segment, longer than inner femoral setae but not as thick and located at mid-segment; tibia short, length equal to one half width of tibia III, one half as broad as long, with one long tactile seta and one short, spinelike seta, the former dorsal in position and slightly longer than outer femoral seta, as long as segment, located dorsally on outer margin near apex; tarsus shorter than tibia, with two minute bristles on inner margin, one seta on outer margin; claw reduced to a minute knob. *Genital papilla*: Length, 32 μ ; width, 46 μ ; subcordate, broadly truncate at apex. *Anal plate*: Small, pyriform, twice as long as broad, length equal to length of tarsus I, two minute apodemes extending forward from anterolateral margins of central disc, two midlateral apodemes, all four extending forward from disc forming acute angles. *Measurements*: Length from tip of rostrum to apex of genital papilla, 173 μ ; width at coxae III, 125 μ ; tip of rostral shield to main body suture, 63 μ ; width of body at main body suture, 96 μ ; length of body including capitulum, 190 μ .

Female: Body narrow, elongate, sides subparallel for most of their length; main body suture distinct, transecting body nearly midway between posterior extremities of legs II and bases of coxae III; four transverse sutures behind main body suture. Apodemes I and anterior median apodeme distinct, the former converging medially opposite middles of coxae I; apodemes II indistinct, extending from inner angles of coxae II in posteriorly converging lines which disappear in area midway between inner coxal angles and median apodeme, the latter disappearing slightly behind posterior angles of coxae II. Posterior apodemes short, those of legs III about one half as long as coxae III, extending anteriorly from bases of coxae III in slightly converging lines; apodemes IV parallel, as long as width of tibia II, extending forward from anterior angles of coxae IV. Genital cleft in posterior half of penultimate segment furcate caudally enclosing area as wide as tibia III. Pseudostigmatic organs prominent, on narrow pedicels as long as expanded tips, the latter egg-shaped, one and one-half times as long as broad; basal

plates subcircular, irregular in outline, diameter equal to width of apical club, situated laterally midway between coxae I and II. Tracheal openings prominent, located at anterolateral angles of rostral shield slightly anterior to first pair of dorsal propodosomal setae. Tracheae clearly visible, converging medially near mid-length of anterior median apodeme, here forming two prominent bilobed expansions. *Dorsal chaetotaxy*: First pair of setae two thirds length of capitulum, situated one half length of seta behind anterolateral angles of rostral shield; second pair of setae twice as long as legs II, located immediately behind bases of pseudostigmatic organs the basal width of tarsus II from lateral margins of body; third pair of setae one third length of coxae III, located two thirds length of seta from lateral margins of body midway between anterior extremities of apodemes III and main body suture; fourth pair of setae one fourth as long as coxa III, located the width of tarsus II anterior to basal condyles of legs III, slightly mesad to these condyles; fifth pair of setae one half length of coxa IV, situated at inner margins of femora III; sixth and seventh pairs of setae in transverse line, both pairs of equal lengths, as long as basal width of femur III, outer pair on lateral margins of body, distance between inner pair slightly greater than distance between inner and outer setae, all four setae aligned on anterior fourth of penultimate hysterosomal segment; eighth pair of setae one and one-half times as long as setae of seventh pair, situated on anterolateral margins of apical hysterosomal segment. *Ventral chaetotaxy*: First pair of setae one half as long as width of tibiotarsus I, located the length of seta mesad to inner angles of coxae I, half length of seta anterior to apodemes I; second pair of setae with length equal to width of tarsus I, situated the length of seta from anterior median apodeme slightly behind inner angles of coxae II; third pair of setae one half length of coxae III, located about midway between anterior extremities of apodemes III and mid-body, setae separated from each other by a distance equal to three fourths length of coxa III; fourth pair of setae with length equal to one half length of setae of third pair, situated opposite distal thirds of coxae III one and one-half times length of seta from inner margins of coxae, separated from each other by a distance equal to length of coxa III; fifth pair of setae with length equal to basal width of femur III, located near apex of body, projecting beyond apex for half their lengths, separated from each other by a distance equal to length of femur III. *Capitulum*: Length, 32μ ; width, 32μ ; subcordate in outline, posterior margin emarginate; one pair of dorsolateral setae as long as tarsus I located

at anterior third of head capsule, projecting forward beyond apex. Palpus two-segmented with a short, ventral seta near inner margin of basal segment and a small subterminal bristle on outer margin of apical segment. *Legs:* Both anterior pairs short, front legs slightly longer than legs II. Leg I three times as long as breadth of coxa at base; coxa broader than long, without setae; femur one and one-half times as long as broad, its outer margin incurved at base and nearly twice as long as inner margin, four setae on segment; genu as broad as long, with four setae; tibiotarsus twice as long as broad at base terminating in a single, stout claw projecting beyond large, bilobed empodium, segment with three clavate setae and eleven normal setae. Leg II twice as long as basal width of coxa; coxa broader than long, subtriangular shape, without setae; femur slightly longer than broad, outer margin long, slightly concave, inner margin short, straight, segment with three setae; genu one and one-half times as broad as long, with three setae; tibia one and one-half times as long as broad, with four setae; tarsus as broad as long, tapering from base to apex which is surmounted by two prominent, spreading claws with a broad empodium projecting beyond, segment with two short, clavate setae and four normal setae. Leg III with coxa narrow, elongate, slightly more than four times as long as broad, its outer margin parallel to sides of body; femur three fifths as long as coxa, lateral margins diverging apically, segment with three setae; tibia twice as long as broad, tapering slightly to apex, with four setae, all on distal half of segment; tarsus twice as long as broad at base, tapering to bluntly rounded tip beyond which is pair of prominent, spreading claws and broad, projecting empodium, segment with four setae one of which is more than twice as long as combined lengths of tarsal segment and its terminal appendages. Leg IV with coxa about as broad as long, triangular in shape; trochanter broader than long, subtriangular, collarlike; third segment slender, elongate, as long as distance between inner angles of coxae II, segment with two setae, one near outer margin at base of segment one and one-half times as long as width of segment at base, other seta ventral at apical fifth of segment, extending one third its length beyond tip of segment; fourth segment narrow, two fifths as long as third segment, terminating in two setae, one apical the other subapical, the latter stout, twice as long as segment, situated the width of segment before apex, terminal seta long, slender, twice as long as segments three and four combined. *Measurements:* Length from tip of capitulum to apex of hysterosoma, 327 μ ; tip of rostral shield to tip of hysterosoma,

312 μ ; front margin of rostral shield to main body suture, 80 μ ; width at main body suture, 106 μ ; width at anterior condyles of coxae III, 120 μ .

Types: Brooksville, Florida, Feb. 3, 1931, W. B. Wood, bamboo. The type slide mounts about fifty specimens, one male of which has been encircled by the present writer and which is hereby designated lectotype.

Location of types: United States National Museum No. 23777 (insect book).

Material examined contained the following data: Brooksville, Florida, Feb. 3, 1921, W. B. Wood, bamboo (Type slide, no. 23777, containing approximately fifty specimens of both sexes); Brooksville, Florida, Feb. 18, 1924 and Feb. 19, 1924, W. T. Owrey, *Phyllostachys bambusoides*; Brooksville, Florida, Feb. 12, 1922, H. L. Sanford, *Phyllostachys bambusoides*; Yokahama, Japan, Nov. 27, 1922, *Phyllostachys quinoi*; Savannah, Georgia, Dec. 18, 1944, Rau, *Phyllostachys bambusoides*.

This species is quite distinctive, particularly in the males. The extreme angular shape of the body, the robust legs and the three, rather than four, pairs of dorsal propodosomal setae readily differentiate the male from other members of the genus. In comparing characters of this sex only, *S. phyllophorus* seems to be most closely related to *S. bancrofti*.

Steneotarsonemus bancrofti (Michael), new combination

(Plates 3, 17 and 22)

Tarsonemus bancrofti Michael, 1890, Roy. Bot. Gard. Kew, Bull. Misc. Info., no. 40, p. 85; Rutherford, 1913, Trop. Agr. Peradeniya, vol. 41, no. 6, p. 490; Banks, 1915, U. S. Dept. Agr. Rept., 108, p. 108; Annand, 1943, U. S. Dept. Agr. Bur. Ent. and Plant Quarantine Rept., 1942-43, p. 12; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 38.

Tarsonemus spinipes Hirst, 1912, Bull. Ent. Res., vol. 3, p. 325; Jones, 1914, Jour. Econ. Ent., vol. 7, no. 6, p. 461; Bianchi, 1940, Proc. Hawaiian Ent. Soc., vol. 10, no. 3, p. 375.

Male: Body short and broad, diamond-shaped, broadest at coxae III, tapering abruptly to posterior, less abruptly to anterior. Rostral shield broadly, angularly truncate at apex, width of apex slightly greater than width of capitulum. Main body suture distinct, transecting body one fourth distance from hind angles of coxae II to anterior condyles of coxae III. Posterior body suture transecting body at anterior angles of coxae IV, distinct for most of its length. Anterior apodemes distinct, those of legs I extending from inner angles of coxae I to point of convergence medially in line with hind

angles of coxae I; median apodeme extending from point of convergence of apodemes I to point in line with hind angles of coxae II, becoming less distinct from anterior to posterior; apodemes II extending from inner angles of coxae II in posteromedial directions, turning abruptly caudad three fourths distance from inner angles of coxae II to median apodeme, converging to point of juncture just before hind extremity of median apodeme. Posterior apodemes distinct, those of legs III extending in anteromedial directions from anterior condyles of coxae III; apodemes IV subparallel to apodemes III, extending forward from anterior angles of coxae IV; apodemes III and IV converging anteriorly, enclosing a broad area terminating anteriorly slightly behind main body suture; median apodeme with anterior extremity in line with anterior condyles of coxae III, extending caudally to point opposite hind margins of coxae IV, broadly expanded at this point. *Dorsal chaetotaxy*: Four pairs of setae on propodosoma, third pair much longer than others; anterior pair as long as tibia I, separated from each other by distance equal to half length of seta, located slightly more than length of seta behind anterior margin rostral shield; second pair one and one-half times as long as first pair, separated from each other by a distance equal to half length of seta, located one third length of seta behind and slightly laterad to first pair; third pair slightly more than twice length of second pair, separated from each other by a distance equal to width of capitulum, setae located one half length seta of second pair behind and slightly laterad to these setae, in line with anterior angles of coxae II; fourth pair of setae twice length of first pair, situated midway between third pair and main body suture. Four pairs of dorsal setae on hysterosoma; first pair slightly longer than fourth pair of propodosomal setae but not as thick, located one third length of seta from lateral margins of body, slightly anterior and medial to basal condyles of coxae III; second and third pairs subequal in length, as long as second pair of propodosomal setae, situated in transverse row in line with posterior thirds of coxae III, inner pair separated from outer pair by a distance equal to two thirds length of seta and separated from each other by a distance equal to one and three-fourths times length of seta, outer pair situated one fourth length of seta medial to inner margins of coxae III; fourth pair of dorsal hysterosomal setae with length equal to basal width of tibia III, situated at lateral margins of genital papilla, about one fourth distance from anterior to posterior extremities of papilla. *Ventral chaetotaxy*: Propodosoma with two pairs of minute setae; first pair as long as

width of tarsus I, situated one and one-half times length of seta laterad from point of juncture of apodemes I; second pair slightly longer than first pair, situated two and one-half times length of seta laterad from point of juncture of apodemes II. Hysterosoma with two pairs of ventral setae; first pair elongate, threadlike, length equal to length tibia II, located one and one-half times length of seta from lateral margins of body, two thirds length of seta behind main body suture, thus being in outer anterior portion of inter-apodemal area delimited by connected anterior extremities of apodemes III and IV; setae of second pair minute, as long as apical width of tibia III, located one half length of seta laterad from apodemes IV at their mid-lengths. *Capitulum*: Length, 40 μ ; width, 39 μ ; subcordate, with posterior margin emarginate, each lobe sharply pointed medially. Dorsolateral setae long, extending slightly beyond apices of palpi; ventral setae as long as apical width of tibia I. Palpi short and broad, projecting slightly beyond apex of capitulum, subapical bristles conspicuous. Chelicerae short, needlelike, projecting between palpi. *Legs*: Legs II larger than legs I, distance between coxae I and II equal to width of tibia II. Leg I with coxa subquadrangular, nearly twice as broad as long, inner margin greatly convex, segment without vestiture; femur twice as long as broad, outer margin incurved basally, segment with three setae; genu one half length of femur, slightly longer than broad at base, tapered from base toward apex, segment with four setae; tibia slightly longer than genu, tapering slightly from mid-segment to apex, with five normal setae and three short, sensory pegs located dorsally side by side near outer margin at about basal third of segment, the middle peg clavate, its length equal to half apical width of segment, inner peg clavate and three fourths length of middle peg, outer peg pointed apically and one half length of middle peg; tarsus one and one-half times as long as broad, tapered slightly to broadly rounded apex, with six normal setae and one clavate seta, the latter with length equal to one half length of segment, located dorsally near outer lateral margin at basal third of segment; broad empodium extends beyond tarsus a distance equal to length of tarsus; tip of single curved claw projects beyond empodium. Leg II with coxa subquadrangular, nearly twice as broad as long, without setae; femur only slightly longer than femur I but much broader, segment as long as combined lengths of genu and tibia I, breadth equal to length of tibia I, with three minute setae; genu slightly longer than broad, tapered slightly from base to apex, with three setae; tibia twice

as long as broad at base, tapered slightly from mid-segment to apex, with four setae; tarsus one and one-half times as long as broad at base, tapering to narrowly rounded apex, with four normal setae, one clavate seta having length equal to basal width of segment situated dorsally near outer margin at basal fourth of segment, one short, clavate seta one half as long as the former situated dorsally near outer margin at basal third of segment, one short, peglike seta with length equal to half basal width of segment located ventrally near outer margin at mid-segment; tarsus surmounted by two large, spreading, curved claws beyond and between which projects a broad empodium. Leg III with coxa subtriangular, one and one-half times as long as broad, length equal to distance between posterior condyle of coxa II and anterior condyle of coxa III, segment without vestiture; femur twice as long as broad, width at apex slightly less than width at base, basifemur partially separated from remainder of segment by a suture, segment with one seta; genu one and one-half times as long as broad, two thirds as long as femur, sides subparallel, with three setae, one of which is stout and spinelike; tibia twice as long as broad at base, tapering from mid-segment to apex, with four setae, one of which is stout and spinelike; tarsus twice as long as broad at base, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a pair of strong, spreading, curved claws between and beyond which extends a broad empodium. Leg IV with coxa slightly longer than broad, as long as femur I, outer margin convex, with one seta; femur about one and one-half times as long as coxa, outer margin slightly convex, sclerotized portion of inner margin straight, width at mid-segment not including flange equal to width of genu III, inner flange occupying apical two thirds of inner margin of segment, broadest opposite apical one fourth of segment, its width at this point equal to greatest width of segment, with one stout bristle having length nearly equal to width of segment located ventrally at middle of base of flange, one normal seta with length equal to width of segment located ventrally at basal juncture of flange with sclerotized portion of segment, one small seta two thirds as long as width of segment situated dorsolaterally on outer margin at apical fourth of segment; tibia one and one-half times as long as broad at base, length equal to two thirds width of femur, outer lateral margin nearly twice as long as inner margin, with one stout seta two thirds as long as femur situated ventrally near outer margin at mid-segment, one short stout bristle with length equal to one half basal width of segment located on outer margin at

apex of segment; tarsus subtriangular, inner margin twice as long as outer margin, segment as broad as long, length about equal to basal width of tarsus III, segment with numerous, small, irregular tubercles, with one minute bristle on dorsal and ventral surfaces of inner margin at about mid-segment, one small dorsal seta on outer margin; tarsus terminated by a short, stout, curved claw only slightly longer than broad at base. *Genital papilla*: Length, 47 μ ; width, 48 μ ; subcordate, with anterior margin deeply emarginate, posterior margin bluntly rounded. *Anal plate*: Central disc as long as apical width of tibia III, broadly rounded at anterior extremity, tapering to narrowly rounded posterior; two diverging hornlike apodemes extending from broadest point in anterolateral directions a distance equal to width of disc. *Measurements*: Tips of palpi to apex of genital papilla, 301 μ ; length from tip of cephalothoracic shield to apex of genital papilla, 264 μ ; width of body measured from outer margins of coxae III, 174 μ ; tip of rostral shield to main body suture, 119 μ ; width of body at main body suture, 140 μ ; length from main body suture to posterior body suture, 90 μ .

Female: Body elongate oval, broadest between main body suture and anterior condyles of coxae III. Anterior apodemes distinct, those of legs I extending from inner angles of coxae I, converging medially in line with posterior extremities of coxae I; median apodeme extending caudad from juncture of apodemes I to point in line with posterior condyles of coxae II; apodemes II extend diagonally from inner angles of coxae II to median apodeme. Posterior apodemes distinct, apodemes III extending in anteromedial directions from anterior condyles of coxae III, their lengths equal to two thirds length of coxa III, anterior third of apodemes parallel to lateral margins of body; apodemes IV one and one-half times as long as width of coxa III, directed anteromedially from posterior extremity at half length of apodeme mesad to inner margin of coxa III at posterior third of segment. Genital cleft occupying entire penultimate segment, caudal extremity of cleft expanded. Pseudostigmatic organs as long as tibiotarsus I, on short, thin pedicels, one half length of broad ovoid apices, the latter twice as long as broad, width equal to one-half width of femur I, organs mounted on ring-like basal plates with diameters equal to width of expanded apices of organs, located a distance equal to diameter behind posterior extremity of coxa I. Tracheal openings distinct as a pair of small sclerotized rings, situated at anterolateral angles of rostral shield, tracheae converging posteriorly forming two sclerotized, elongate, bilobed structures located midway between inner angles anterior

pairs of legs, tracheae indistinct behind these structures. *Dorsal chaetotaxy*: Two pairs of dorsal setae on propodosoma; first pair with length equal to width of femur I, located about the length of seta behind anterolateral angles of rostral shield; second pair with length about equal to length of leg I, located above and slightly behind basal rings of pseudostigmatic organs. Six pairs of dorsal setae on hysterosoma; first pair of setae with length equal to length of femur II, located one and one-half times length of seta from lateral margins of body directly above anterior extremities of apodemes III; second pair of setae small, length equal to length of genu II, located the length of seta from lateral margins of body, slightly anterior to previous pair of setae; third pair of setae with length equal to width of tarsus III, located the length of femur III from lateral margins of body in line with posterior fifths of coxae III; fourth pair of setae with length subequal to third pair, located the length of femur III behind and slightly mesad to hind extremities of coxae IV, separated from each other by a distance equal to four times length of seta; fifth and sixth pairs setae arranged in transverse row on anterior margin penultimate segment, subequal in length, one and one-half times as long as basal width of tarsus III, outer pair near lateral margins of body, inner pair separated from each other by distance equal to three times length of seta. *Ventral chaetotaxy*: Two pairs of setae on propodosoma; first pair minute, one fourth as long as basal width of tibiotarsus I, located at junctures of apodemes I with inner angles of coxae I; second pair of setae as long as width of genu II, located one and one-half times length of seta laterad from juncture of apodemes II with median apodeme. Three pairs of ventral setae on hysterosoma; anterior pair with length equal to one half length of coxa III, located slightly medial to anterior extremities of apodemes III; second pair with length equal to width of coxa III, located at hind extremities of apodemes IV; third pair of setae stout, length equal to width of trochanter IV, located at apex of body, separated from each other by distance equal to twice length of seta. *Capitulum*: Length, 40 μ ; width, 39 μ ; subcordate, caudal margin truncate, anterior margin bluntly rounded, with chelicerae and palpi projecting slightly beyond apex. Dorsolateral setae more than half length of capitulum; palpi normal, indistinctly segmented. *Legs*: Anterior pairs short. Leg I with coxa subquadrangular, broader than long, without setae; femur one and one-half times as long as broad, outer margin incurved basally, with three setae; genu almost one and one-half times as long as broad at base, tapering slightly from mid-segment

to apex, with four setae; tibiotarsus nearly three times as long as broad at base, tapering slightly to broadly rounded apex, an indistinct transverse suture partially dividing segment at apical third, with three specialized sensory setae and ten normal setae; tibiotarsus terminating in narrow pedicel, its length equal to one half basal width of segment, from apical extremity of which projects a single, strong, curved claw as long as pedicel and a broad, oval empodium. Leg II with coxa subquadrangular, nearly twice as broad as long, without vestiture; femur twice as long as broad at apex, outer margin incurved at basal half of segment, with three setae; genu as broad as long, with one stout, pointed, dorsal peg one half as long as segment, situated on inner margin at basal fourth of segment, one seta slightly longer than segment located ventrally near outer margin at basal third, one short, stout, pointed peg one half length of segment situated ventrally on inner margin at mid-segment; tibia one and one-half times as long as broad at base, tapering slightly from base to apex, with four setae; tarsus about as broad as long, tapering abruptly to narrowly rounded apex, with one clavate seta one half as long as segment located middorsally at basal third, one short, stout, pointed seta situated dorsally near outer margin at basal fourth, one short, peglike seta one third as long as segment situated on outer margin at apical third, four normal setae; tarsus surmounted by short, narrow pedicel bearing two strong, curved, spreading claws apically, a large empodium projecting between claws. Legs III situated well behind legs II, with coxa narrow, elongate, sides parallel to body margins, about four times as long as greatest breadth, length equal to combined lengths of femur, genu and tibia of leg II, segment without ornamentation; femur about three and one-half times as long as broad at apex, lateral margins diverging from basal third to apex, with three setae; tibia two and one-half times as long as broad, sides subparallel, with four setae; tarsus about two thirds as long as tibia, three times as long as broad at base, slightly narrowed at mid-segment, with four setae; tarsus surmounted by a pair of strong, curved, spreading claws between and beyond which extends a broad empodium. Leg IV with coxa small, subquadrangular, slightly longer than broad, without vestiture; trochanter collarlike, as broad as long; third segment elongate, cylindrical, sides parallel, length equal to combined lengths of tibia and tarsus III, width one half width of tibia III, one seta with length equal to width of segment, located ventrally near inner margin one half length of seta from base of segment, one seta with length equal to two and one-half times

width of segment, situated ventrally near inner margin, one half length of seta from apex of segment; fourth segment about three times as long as broad, one fourth as long as third segment, with one long, stout, ventral seta having basal diameter equal to one half width of segment, its length equal to two and one-half times length of segment, one apical seta twice as long as leg. *Measurements*: Length from tip of capitulum to apex of abdomen, 328 μ ; tip of rostral shield to tip of abdomen, 290 μ ; front margin of rostral shield to main body suture, 90 μ ; width at main body suture, 88 μ .

Types: Australia, on *Saccharum officinarum*.

Location of types: Unknown.

Material examined included specimens with the following data: Canal Point, Fla., May 16, 1922, E. W. Brandes, in sugarcane stalk; Arlington Farm, Va., Feb. 5, 1935, R. D. Rands, on sugarcane; Arlington, Va., Feb. 11, 1935, F. F. Smith, sugarcane in greenhouse; Experiment Sta., Houma, La., Oct. 10, 1935, J. W. Ingram, on sugarcane; Vicosia, Brazil, Nov. 8, 1932, E. J. Hambleton, on sugarcane; Tahiti, Society Islands (at Wash. D. C.), Sept. 29, 1936, D. P. Limber, on *Saccharum officinarum*.

It appears that this species occurs wherever sugarcane grows. To date it has been completely host specific, this writer being cognizant of no records of specimens taken from any host other than *Saccharum officinarum*.

The species was first described by Bancroft (1877), but this author neglected to identify it with a name. In 1890 Michael proposed the name *Tarsonemus bancrofti* and as a description referred to the rather complete one supplied earlier by Bancroft. The present writer is in complete agreement with Ewing (1939) in his refutation of Hirst's (1912) claim that Bancroft's description was not accurate enough for proper identification, a claim upon which he based his right to propose the species *Tarsonemus spinipes*. This latter name has since been duly recognized by most workers as a synonym for *S. bancrofti*.

Steneotarsonemus hyaleos, new species

(Plates 1, 5, 17 and 22)

Male: Body elongate oval, tapering from main suture body to capitulum, sides subparallel between coxae III and main body suture, bluntly rounded caudad from coxae III. Main body suture and posterior body suture distinct, the latter transecting body at posterior extremities of coxae III. Apodemes of legs I converging

abruptly with median apodeme which extends to converging apodemes of legs II, these terminating at a point about one half distance from juncture of apodemes I to main body suture. Apodemes of legs III and IV converging indistinctly, defining an area broadest at anterior extremities of coxae III. Posterior median apodeme distinct, extending from tip of body to forward extremities of apodemes of hind legs; apodemes of legs IV closing indistinctly with median apodeme anteriorly at point the length of coxa III behind main body suture. Venter of body minutely, densely and indistinctly punctured in area in front of anterior terminations of posterior apodemes. *Dorsal chaetotaxy*: Three pairs of strong setae on anterior half of propodosoma, middle pair slightly weaker than others, all three pairs arranged equidistant from converging lateral margins of propodosoma and nearly equidistant from each other; fourth pair of dorsal propodosomal setae twice as long as setae of first pair, located behind third pair a distance equal to distance between first and third pairs; hysterosoma with four pairs of dorsal setae. *Ventral chaetotaxy*: Two pairs of ventral setae on propodosoma; first pair minute, located the width of tarsus I from midline, opposite juncture of apodemes I; second pair small, situated near centers of areas defined by apodemes II, inner bases of coxae II and main body suture. Two pairs of ventral hysterosomal setae; first pair rather prominent, situated slightly behind and equidistant from united anterior extremities of apodemes III and IV; second pair subequal in length to first pair, located within area defined by apodemes III and IV, situated very close to apodemes IV one third length of apodeme from junction of apodeme with basal condyle of coxa IV. *Capitulum*: Subcordate, with posterior margin emarginate; length including projecting palpi, 29 μ ; greatest width, 24 μ . Dorsal setae with length equal to two fifths width of capitulum, located near outer margins at apical third, separated from each other by their combined lengths. Ventral setae one half as long as dorsal setae, situated at apical third of capitulum, separated from each other by their combined lengths. Palpi indistinctly three-segmented, projecting, apical segment with a minute subterminal bristle and a minute lateral bristle near base. Chelicerae short, needlelike, extending to tips of palpi. *Legs*: Anterior pairs subequal, short, most segments broader than long; empodia large, projecting beyond claws, each of the four anterior tarsi with one clavate, sensory seta, remaining segments of four anterior legs without clavate setae. Leg III short and broad, with coxa coarsely, densely punctured, less than one and one-half times as long as broad; em-

podium prominent; clavate sense setae absent on leg III. Leg IV with coxa as broad as long, a single seta on ventral surface at posterolateral angle; femur nearly twice as long as width at base, inner and outer margins strongly convex, the former with a nearly square, flangelike expansion at middle, each side of which is about equal in length to apical breadth of femur, three distinct setae on segment, the first situated ventrally on inner margin just beyond base of flange connection with femur proper, its length equal to length of flange, second seta twice as long as former, situated near margin just beyond distal extremity of flange connection, third seta prominent, located mid-dorsally between apex of femur and base of outer margin of flange; tibia about as broad as long, a strong seta situated ventrally near outer margin, a clavate, sensory seta located dorsally near outer margin, both of these setae on distal half of segment; tarsus twice as broad as long, with two short setae on inner margin and one short seta on outer margin; claw barely twice as long as width at base. *Genital papilla*: Length, 25μ ; width, 23μ ; subcordate, with anterior margin deeply emarginate, hind margin rounded truncate. *Anal plate*: Distinct, but radiating apodemes not clearly delimited. Central disc located two thirds length of genital papilla anterior to its anteromedial extremity, diameter of disc about equal to one half basal width of tarsus III. Two apodemes extending in anterolateral directions from disc, the other apodeme extending caudomedially, all about as long as tibia, III, terminating indistinctly. *Measurements*: Length from tip of rostrum to apex of genital papilla, 173μ ; greatest width, 90μ ; tip of rostral shield to main body suture, 67μ ; width of body at main body suture, 79μ ; length from main body suture to posterior body suture at mid-dorsum, 72μ .

Female: Body narrow, elongate, sides subparallel for most of their lengths; main body suture distinct, transecting body between coxae II and bases of coxae III; five distinct, dorsal, transverse sutures behind main body suture dividing hysterosoma into six segments. Anterior apodemes well-defined, those of legs I joining median apodeme opposite anterior bases of coxae I; leg II apodemes terminating between second pair of ventral setae and median apodeme, the latter indistinctly terminating just before main body suture. Posterior apodemes short, those of legs III converging anteriorly, terminating slightly behind third pair of ventral setae at point midway between lateral margins of body and mid-line, length of apodemes III about one third length of coxa III; apodemes IV converging anteriorly, terminating opposite mid-lengths of coxae III

two thirds the distance from inner margin of coxa III to midline, the posterior extremities of apodemes IV at location of fourth pair of ventral setae. Posterior median apodeme absent. Genital cleft extending anteriorly from hind margin of penultimate segment more than half length of segment, the cleft furcate caudally, forming a nearly enclosed subcircular area about equal in diameter to width of tarsus III. Pseudostigmatic organs prominent, narrow pedicels shorter than length of expanded apices, the latter one and one-half times as long as greatest breadth appearing regular, egg-shaped; organs arising from heavily sclerotized, circular plates the diameters of which are slightly less than breadth of apical clubs, width of latter equal to width of tarsus II at base; basal plates of organs situated laterally, their posterior margins in line with front margins of coxae II. Tracheal openings with prominent sclerotized rings, located just behind anterolateral angles of cephalothoracic shield immediately beside first dorsal propodosomal setae, tracheae converging posteriorly and intersecting at middle of anterior median apodeme. *Dorsal chaetotaxy*: Two pairs of dorsal propodosomal setae; first pair prominent, nearly equal in length to length of capitulum, situated immediately beside tracheal openings; second pair prominent, length equal to length of leg II, situated immediately behind posterior margin of basal rings of pseudostigmatic organs. Six pairs of dorsal setae on hysterosoma; first pair with length equal to length of coxa III, situated on lateral margins of body midway between main body suture and anterior extremities of leg III apodemes; second pair of setae having length equal to one half length of coxae III, situated at caudal margin of first hysterosomal segment slightly anterior to and toward middorsum from basal condyles of coxae III; third pair, slightly longer than coxae IV, situated at caudal margin of third hysterosomal segment, in line with and above bases of coxae IV; fourth and fifth pairs of setae with lengths equal to length of apical segment of leg IV, the outer pair of setae situated on lateral margins of body at penultimate, transverse, hysterosomal suture, the other pair located at anterior third of penultimate segment the length of seta from middorsum; sixth pair of setae, one and one-half times as long as setae of fifth pair, situated on lateral margins of body close to anterior extremity of last hysterosomal segment. *Ventral chaetotaxy*: Two pairs of ventral propodosomal setae; first pair small, equal in length to width of tarsus I at base, located just medial to intersections of apodemes I with inner angles of coxae I; second

pair of setae equal in length to width of tibia II at base, situated just posterior to hind extremities of apodemes II, the length of seta from median apodeme. Three pairs of ventral hysterosomal setae; first pair with length slightly greater than half the length of coxa III, located slightly anterior to forward extremities of apodemes III, the distance between setae being about equal to length of seta; second pair of setae slightly shorter than setae of first pair, situated in line with distal thirds of coxae III, one third the distance from inner margin of coxa to mid-body; third pair of setae equal in length to setae of second pair, situated at apex of body, the distance between them about twice the length of seta. *Capitulum*: Length, 25 μ ; width 25 μ ; broadest at base, tapering very slightly to bluntly rounded apex, hind margin shallowly emarginate; a pair of strong dorsal setae one and one-half times as long as basal width of tarsus I, located near lateral margins of capitulum slightly anterior to bases of palpi; palpi indistinctly two-segmented, apical segment with a minute, subterminal bristle, a ventral seta as long as basal width of tarsus I located near base of each palpus. *Legs*: Anterior pairs short, slightly longer than half the greatest width of body. Leg I with coxa subtriangular, broader than long, without setae; femur one and one-half times as long as broad, with outer margin incurved at base, with four setae; genu nearly as broad at base as long, with four setae; tibiotarsus one and one-half times as long as broad, with two clavate, annulated sensory setae, one rodlike seta and twelve normal setae; tibiotarsus terminating in single claw projecting beyond broad, bilobed empodium. Leg II with coxa twice as broad as long, without setae; femur one and one-half times as long as broad, with three setae; genu broader than long, with two lateral setae, one stout, dorsal, lanceolate seta; tibia nearly as broad as long, with four normal setae; tarsus one and one-half times as long as broad, with two clavate, sensory setae and four normal setae; tarsus terminating in two strong claws beyond which projects a broad, subcircular empodium. Leg III with coxa narrow, elongate, four times as long as broad at apex, without setae; femur broader at apex than at base, three times as long as width of apex, with three setae; tibia tapering from base to apex, three times as long as broad at base, with four setae, three of which are on apical portion of segment; tarsus one half as long as tibia, four times as long as broad at base, expanded slightly at mid-segment, with four setae, all on apical half of segment; tarsus terminating in short pretarsus, one half as long as tarsus, bearing at its apex two strong claws beyond which projects a large, subcircular empodium. Leg

IV with coxa slightly longer than broad, inner margins slightly concave; trochanter ringlike, twice as broad as long; third segment narrow, elongate, slightly more than twice length of genu I, width at base equal to one half width of coxa III, two setae on segment, one short, ventrolaterally situated on outer margin, one half width of segment from its base, the other with length equal to length of femur III, located the width of segment from its apex; fourth segment narrow, elongate, length equal to length of tibia I, terminating in two long setae, one subapical, ventral, its length equal to distance from base of third segment to middle of fourth segment, terminal seta more than twice as long as subterminal seta. *Measurements*: Length from tip of capitulum to apex of opisthosoma, 228 μ ; tip of rostral shield to tip of opisthosoma, 208 μ ; front margin of rostral shield to main body suture, 71 μ ; width of body at main body suture, 86 μ .

Holotype: Male, Pescadero, San Mateo Co., Calif., Oct. 28, 1949, R. E. Beer, salt-marsh grass.

Allotype: Female, Bolinas, Marin Co., California, Oct. 23, 1949, A. E. Pritchard, salt-marsh grass.

Paratypes: Four males, one female, same data as holotype, ten females, same data as allotype; one larva (morphotype), Marin Co., Calif., Nov. 13, 1949, salt-marsh grass, A. E. Pritchard.

Living specimens of both sexes of this mite are semitransparent with the body extremely flattened dorsoventrally. They were collected in the greatest numbers near the growing tips of salt-marsh grass beneath the sheaths of the grass blades, a habitat for which they are well adapted by their flattened bodies. Because of their nearly hyaline color, they are almost impossible to see without the aid of a low power microscope.

Steneotarsonemus spirifex (Marchal), new combination

(Plates 8, 17 and 22)

Tarsonemus spirifex Marchal, 1902, Bull. Soc. Ent., France, vol. 4, p. 99; Wahl and Müller, 1914, Rept. Augustenberg Agr. Exp. Inst., Stuttgart, p. 64; Lind et al, 1914, Beret. Statens Forsøgsvirksomhed i Plantekultur, Copenhagen, p. 3; Banks, 1915, U. S. Dept. Agr. Rept., 108, p. 104; Schoevers, 1915, Tijdschr. over Plantenziekten, Wageningen, p. 111; Oudemans, 1915, Tijdschr. over Plantenziekten, Wageningen, p. 124; Moznette, 1917, Jour. Agr. Res., vol. 10, no. 8, p. 373; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 40.

Male: Body regular oval, tapering from main body suture to capitulum; broadest between main body suture and posterior extremities of coxae III, tapering from this point to apex of hystero-

soma. Main body suture and posterior body suture distinct dorsally, the latter transecting body slightly behind coxae III. Anterior apodemes well-defined, those of legs I converging medially slightly behind posterior margins of coxae I; apodemes II converging medially, terminating before median apodeme in line with hind angles of coxae II; median apodeme terminating just before main body suture. Posterior apodemes distinct, those of legs III and IV joined anteriorly enclosing a bluntly rounded area; posterior median apodeme well-defined from point slightly behind anterior extremities of apodemes III and IV to hind margins of coxae IV.

Dorsal chaetotaxy: Three pairs of strong setae on anterior half of propodosoma, spaced equidistant from each other and equidistant from lateral margins of body; anterior pair slightly longer than width of femur I, situated the length of seta behind anterior margin of rostral shield, separated from each other by distance equal to three fourths length of seta; second pair one half as long as first pair, the length of seta behind first pair and this distance from lateral margins of body; third pair twice as long as first pair, located behind second pair the same distance separating first and second pairs; fourth pair slightly longer than setae of first pair, located on posterior fourth of propodosoma two thirds length of seta from lateral body margins, this distance anterior to main body suture. Four pairs of dorsal setae on hysterosoma; first pair as long as combined lengths of tibia and tarsus II, located on lateral margins of body midway between main body suture and anterior condyles of coxae III; second pair of setae as long as width of genu III, situated the length of seta behind anterior condyles of coxae III, the length of seta from lateral margins of body; third pair of setae one and one-half times as long as genu III, situated in transverse line with setae of second pair, between body margin and genital papilla; fourth pair of setae as long as width of genu III, located near apex of hysterosoma beside genital papilla, separated from each other by a distance equal to four times length of seta.

Ventral chaetotaxy: Four pairs of ventral setae; first pair minute, length about equal to half basal width of tarsus I, located the length of seta behind apodemes I the same distance laterad to anterior median apodeme; second pair of setae two and one-half times as long as first pair, located one and one-half times length of seta laterad to median apodeme, in line with hind condyles of coxae II; third pair of setae small, located near forward extremities of interapodemal areas delimited by connected apodemes III and IV; fourth pair of ventral setae small, located in same interapodemal area as third pair the

length of seta from apodeme IV, in line with mid-lengths of coxae III. *Capitulum*: Length, 30μ ; width, 33μ ; subcordate, with posterior margin broadly truncate. Dorsal setae having length equal to two fifths greatest width of capitulum, situated near outer margins at apical two fifths of capsule, separated from each other by a distance equal to their combined lengths. Ventral setae one half as long as dorsal setae, located in line with latter, separated from each other by a distance equal to one and one-half times length of seta. Palpi short and broad, nearly as broad at base as long, indistinctly segmented, scarcely projecting beyond apex of capitulum, subterminal bristles conspicuous. Chelicerae long, needlelike, slightly longer than palpi, their tips projecting a short distance beyond apices of palpi. *Legs*: Anterior pairs subequal, shorter than distance from tip of rostral shield to main body suture. Leg I with coxa broader than long, subrectangular, without setae; femur one and one-half times as long as broad, outer margin incurved basally, inner margin straight, segment with three setae; genu as broad as long, with four setae; tibia slightly longer than broad, with three normal setae, one short, sensory peg, one long, clavate seta and one short, spinelike seta, these three specialized setae situated dorso-laterally in a transverse line near outer margin; tarsus surmounted by a large, broad empodium beyond which projects tip of single, stout, curved claw. Leg II with coxa broader than long, subrectangular, without setae; femur twice as long as broad, with outer margin convex basally, inner margin straight and half as long as outer margin, segment with three setae; tibia slightly longer than broad at base, tapering slightly toward apex, with four setae; tarsus slightly longer than broad at base, tapering to bluntly rounded apex, with one clavate seta two thirds as long as basal width of segment located middorsally on basal fourth of segment, one short, clavate seta one half as long as former located dorsally on outer margin at mid-segment and four normal setae; tarsus surmounted by a pair of large, spreading, curved claws beyond which projects a large, bilobed empodium. Leg III with combined length of four apical segments greater than combined length of four apical segments of leg I; coxa one and one-half times as long as broad at apex, without setae; femur more than twice as long as broad, lateral margins concave medially, segment with three setae; genu slightly longer than broad, sides diverging slightly toward apex, with two setae; tibia nearly twice as long as broad at base, tapering slightly toward apex, with four setae; tarsus one and one-half times as long as broad, tapering to rounded apex, with three setae; tarsus sur-

mounted by two large, spreading, curved claws beyond which projects a broad, bilobed empodium. Leg IV robust; coxa with outer margin convex and twice as long as inner margin, segment slightly broader at apex than long, with one ventral seta on outer margin at mid-segment; femur twice as long as broad at base, outer margin convex for entire length of segment, inner margin with basal fourth convex apical third concave, a prominent, oval, lateral expansion at mid-segment, sclerotized portion of femoral expansion about as long as apical breadth of femur with its basal width about same dimension, one narrow, hyaline expansion projecting beyond sclerotized area and a broad hyaline expansion projecting beyond this, segment with three setae of about equal length, slightly longer than apical width of femur; tibia nearly twice as broad as long, with one large, clavate seta having length equal to width of segment, situated dorsally near outer margin at apical fourth of segment, one long tactile seta, three times as long as width of segment, situated ventrally near outer margin at mid-segment; tarsus one and one-half times as broad as long, with a single short bristle on outer, dorsolateral margin and two short bristles on inner margin; tarsus surmounted by a short, strong, curved claw. *Genital papilla*: Length, 34μ ; width, 29μ ; subcordate, with anterior margin deeply emarginate, crescent-shaped, narrow, sclerotized plate transecting papilla dorsally at caudal third, lateral extremities of plate narrowly pointed and directed caudolaterally, projecting beyond lateral margins of papilla, a pair of pointed, dorsally directed aedeagi projecting from plate between mid-papilla and lateral margins of papilla. *Anal plate*: Prominent; with central body diamond-shaped, as long as tibia IV, its pointed posterior extremity situated the width of tibia III anterior to forward margin of genital papilla, hornlike anterior diverging arms of apodemes curved and extending in anterolateral directions a distance equal to one and one-half times length of central body. *Measurements*: Length from tip of rostrum to apex of genital papilla, 200μ ; width of body at point between anterior coxal condyles of legs III and main body suture, 130μ , tip of rostral shield to main body suture, 75μ .

Female: Body elongate oval, broadest at main body suture. Anterior apodemes distinct, those of legs I intersecting anterior extremity of median apodeme slightly behind inner coxal condyles of legs I; apodemes II extending from inner coxal condyles of legs II in caudomedial directions, terminating just before intersection with median apodeme, the latter continuing in a posterior direction de-

creasing in distinctness from point in line with hind margins of coxae II to its extremity midway between coxae II and main body suture. Posterior apodemes distinct, those of legs III extending in anteromedial directions from anterior condyles of coxae III for a distance equal to half length of coxa, the forward portions of apodemes with small, bulbous thickenings beyond which extend the recurved anterior extremities; apodemes IV thin and threadlike, extending from points the width of coxa III medial to posterior fourths of coxae III in anteromedial directions to points in line with anterior fourths of coxae III, the forward extremities of apodemes IV separated by a distance equal to length of tibia III; posterior median apodeme absent. Two short transverse apodemes, with lengths equal to half width of genu II, situated just anterior to main body suture, these apodemes with posterior extremities innermost, extending in diagonal direction to anterior extremities. Genital cleft extending as a slit from middle of penultimate segment to its hind margin where it terminates in a small, circular plate from each lateral margin of which a short, curved cleft projects forward. Pseudostigmatic organs conspicuous, ovoid apices longer than narrow pedicels, the latter attached basally to heavily sclerotized, ring-like plates nearly equal in diameter to width of apical expansions of organs; basal rings situated closer to anterior margins of coxae II than to posterior margins of coxae III. Tracheal openings distinct as sclerotized rings situated immediately behind anterolateral margins of rostral shield; tracheae extending posteriorly from openings to point of convergence at mid-body between anterior pairs of legs, at this point tracheae thicken into two bilobed, elongate structures each as long as apical width of femur. *Dorsal chaetotaxy*: Two pairs of dorsal setae on propodosoma; one pair as long as femur I, located dorsolaterally immediately behind stigmatal openings; second pair of setae about as long as legs I, situated near lateral margins of body slightly behind and medial to basal rings of pseudostigmatic organs. Six pairs of dorsal hysterosomal setae; two pairs of setae in line transversally, outer pair as long as tibia II, situated the length of seta from lateral margins of body, half length of seta behind main body suture, inner pair as long as genu II, located the length of seta behind main body suture; third pair of setae with length equal to width of femur III, located slightly behind and laterad to coxae IV; fourth and fifth pairs of setae subequal in length, as long as width of tibia IV, outer pair located on lateral margins of body the length of seta in front of penultimate hysterosomal suture, inner pair located in line with outer pair, separated from each other by

distance equal to twice length of seta; sixth pair of setae slightly longer than apical segment of leg IV, located on lateral margins of apical histerosomal segment. *Ventral chaetotaxy*: Two pairs of ventral propodosomal setae; one pair with length equal to width of tarsus I, located slightly in front of mid-lengths of apodemes I; second pair of setae slightly longer than first pair, located between inner condyles of coxae II and anterior median apodeme, two thirds length of seta behind apodemes II. Two pairs of ventral hysterosomal setae; two long setae as long as coxa III, located the basal width of tarsus I in front of anterior extremities of apodemes III; second pair of setae as long as length of apical segment of leg IV, located on apodemes IV, a distance one fourth length of apodemes from posterior extremities. *Capitulum*: Length, 32μ ; width, 30μ ; subcordate, caudal margin deeply emarginate, anterior margin bluntly rounded. Setae of capitulum normal, palpi indistinctly segmented. *Legs*: Anterior pairs short and stout, length subequal, about as long as half width of body at main body suture. Leg I with coxa subquadrangular, slightly longer than broad, without setae; femur one and one-half times as long as broad, with three setae; genu nearly one and one-half times as long as broad, with four setae; tibiotarsus about twice as long as broad at base, with three specialized, sensory setae and ten normal setae; tibiotarsus surmounted by a long, broad empodium beyond which projects tip of strong, curved claw. Leg II with coxa subquadrangular, slightly broader than long, without setae; femur about one and one-half times as long as broad, outer margin incurved basally, segment with three setae; genu as broad as long, with three setae; tibia one and one-half times as long as broad, with four setae; tarsus slightly longer than broad at base, tapering from base to narrowly rounded apex, with two short, clavate setae, the length of one equal to half the basal width of segment, situated dorsally near inner margin the length of seta from base of segment, the shorter seta one half as long as former, located near outer margin opposite other clavate seta, three normal setae; tarsus terminated by pair of spreading, curved claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa narrow, elongate, four times as long as greatest breadth, without vestiture; femur two thirds as long as coxa, apical width equal to one third length of segment, lateral margins divergent from basal third to apex, segment with three setae; tibia slightly shorter than femur, tapered from base toward apex, width at base one third length, with four setae; tarsus narrow, elongate, sides subparallel for most of their lengths, apex bluntly

rounded, with three setae; tarsus surmounted by a pair of large, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa subquadrangular, slightly broader at apex than at base, slightly longer than greatest breadth, length equal to width of coxa III; trochanter subtriangular, broader than long; third segment slender, elongate, tapered slightly from base to apex, as long as combined lengths of femur and genu I, segment with one basal seta one third length of segment, located on outer ventral margin the width of segment from base, one ventral seta nearly half as long as segment located mid-ventrally twice breadth of segment from apex; fourth segment narrow, elongate, slightly expanded at apex, length slightly greater than breadth of tibia III at base, with two elongate setae on segment, one situated ventrally at apical fourth of segment, its length three times length of segment, the other seta on dorsal surface at apex of segment, its length more than twice combined lengths of two apical segments of leg IV. *Measurements*: Length from tip of capitulum to apex of opisthosoma, 314 μ ; tip of rostral shield to tip of opisthosoma, 288 μ ; front margin of rostral shield to main body suture, 81 μ ; width at main body suture, 131 μ .

Types: Vienna, Austria, on *Avena sativa*.

Location of types: Unknown.

Material consulted and studied by the present author included specimens identified with the following data: Ithaca, N. Y., Apr. 16, 1929, W. E. Blauvelt, corn; Douglas, Ariz., Aug. 25, 1932, W. W. Jones, on *Panicum obtusum*; Biophysical greenhouse, Inspection H., Wash. D. C., from teosinte plants, F.H.B. 83699; Manhattan, Kansas, Sept. 16, 1946, D. A. Wilbur, buffalo grass; Riverside, Calif., Aug. 1, 1947, E. W. Baker, Bermuda grass.

This species is rather well known, easily recognized and generally distributed.

Steneotarsonemus pallidus (Banks), new combination

(Plates 4, 17 and 22)

Tarsonemus pallidus Banks, 1901, Proc. Ent. Soc. Washington, vol. 4, p. 294; Banks, 1907, Proc. U. S. Natl. Mus., vol. 32, no. 1553, p. 615; Banks, 1915, U. S. Dept. Agr. Rept., 108, p. 104; Weiss, 1915, Ent. News, vol. 26, no. 4, p. 149; Ewing, 1917, Jour. Econ. Ent., vol. 10, no. 5, p. 497; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 41; Garman, 1917, Maryland Agr. Exp. Sta. Bull., 208, p. 327; Moznette, 1917, Jour. Agr. Res., vol. 10, no. 8, p. 373; Rose, 1917, Agr. Gazette, Canada, vol. 4, p. 174; Dustan, 1929, Ann. Rept. Quebec Soc. Protection Plants (1928-29), p. 48; Doucette and Baker, 1932, Jour. Econ. Ent., vol. 25, no. 2, p. 417; Ewing and Smith, 1935, Proc. Ent. Soc. Washington, vol. 36, p. 267; Smith, 1935, Jour. Econ. Ent., vol. 28, no. 1, p. 91; Smith and Goldsmith, 1936, Hilgardia, vol. 10, no. 3, p. 53;

- Massee, 1937, Pests of fruit and hops, London, p. 229; Massee, 1944, Rept. East Malling Res. Sta. (1943), p. 58; Essig and Hoskins, 1944, California Agr. Extension Cir., 87, p. 418.
- Tarsonemus fragariae* Zimmerman, 1905, Zeitschr. Mährischen Landesmuseums, vol. 5, no. 1, p. 91; Schoyen, 1914, Christiania, p. 31; Ferdinandsen and Rostrup, 1919, Tidskr. Planteavl., vol. 26, p. 683; Gram and Rostrup, 1924, Tidskr. Planteavl., vol. 30, p. 361; Naumann, 1924, Kranke Pflanze, Dresden, vol. 1, no. 7, p. 134; Massee, 1930, Gard. Chron., vol. 87, no. 2250, p. 110; Massee, 1930, Jour. Pomol. and Hort. Sci., vol. 8, no. 4, p. 305; Massee, 1931, Ann. Rept. East Malling Res. Sta., vol. 2 (Supplement 1928-30), p. 189; Massee, 1933, Ann. Rept. East Malling Res. Sta. (1933), p. 117; Ewing and Smith, 1935, Proc. Ent. Soc. Washington, vol. 36, p. 267.

Male: Body broad oval, broadest just anterior to forward extremities of coxae III. Apodemes conspicuous and well-defined, those of legs I as long as tibia I, extending in posteromedial directions from innermost angles of coxae I, converging medially in line with anterior extremities of coxae II. Apodemes II about twice as long as apodemes I, subparallel to the latter, curving abruptly caudad just before intersection with median apodeme, terminating indistinctly just beyond this point. Anterior median apodeme extending indistinctly from main body suture to point opposite posteromedial termina of apodemes II, well defined from this point to its anterior extremity at V-shaped juncture of apodemes I. Apodemes III clearly defined for their entire lengths, extending from anterior extremities of coxae III in anteromedial direction, curving at right angles at points the length of femur I behind main body suture, intersecting apodemes IV near forward extremities of the latter. Apodemes IV extending from outer basal angles of coxae IV in anteromedial directions, converging with apodemes III and median apodeme anteriorly, curving outward just behind anterior extremities of apodemes III, intersecting median apodeme just behind these points. Posterior median apodeme bifurcate caudally, the arms extending anteriorly from inner basal angles of coxae IV, converging at point in line with posterior thirds of coxae III, the apodeme extending forward to intersection with apodemes IV at point a distance equal to combined lengths of femur, genu and tibia III in front of anterior extremity of genital papilla. Anterior margin of propodosoma not extended to form a cephalothoracic shield, its forward extremity broadly truncate, slightly concave. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae in linear arrangement, the setae equidistant from lateral margins of propodosoma; first pair of setae with length equal to greatest width of capitulum, located the length of seta from anterior margin of propodosoma, four fifths length of seta from lateral margins of propodosoma; setae of second pair three fifths as long as setae of

first pair, situated two thirds length of seta behind and slightly laterad from setae of first pair; third pair of setae about two and one-half times as long as setae of first pair, located a distance three fifths length of second seta behind and slightly laterad from latter; fourth pair of setae slightly shorter than second pair, situated two thirds length of seta behind and slightly laterad from setae of third pair. Hysterosoma with four pairs of dorsal setae; first pair as long as first pair of propodosomal setae, situated near lateral margins of body midway between anterior extremities of coxae III and main body suture; second pair of setae two thirds as long as first pair, slightly stouter than latter, located near lateral margins of body in line with anterior thirds of coxae III; third pair of dorsal hysterosomal setae subequal in length to setae of second pair, located the length of seta from caudolateral margins of body in line with bases of coxae IV; fourth pair of setae slightly longer than third pair, situated near caudolateral margins of body beside basal third of genital papilla, setae separated from each other by a distance equal to two and one-half times length of seta. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair minute, length equal to one-half basal width of tarsus I, located near centers of interapodemal areas defined by apodemes I, II and median apodeme; second pair of setae one half as long as tibia I, located slightly mesad from centers of interapodemal areas defined by apodemes II, median apodeme and main body suture. Hysterosoma with two pairs of setae, one seta of each pair located in each interapodemal area delimited by apodemes III and IV; setae of first pair with length equal to two thirds basal width of tarsus I, located one half length of seta from apodemes III in a line with anterior extremity of median apodeme; setae of second pair one and one-half times as long as former setae, situated one half length of seta from apodeme IV, two fifths length of apodeme from its posterior extremity. *Capitulum*: Subcordate, posterior margin truncate; length including projecting palpi, 38 μ ; greatest width, 31 μ . Dorsal setae with length equal to one half greatest width of capitulum, located near lateral margins at apical two fifths. Ventral setae one half as long as dorsal setae, situated near bases of palpi, separated from each other by a distance equal to length of seta. Palpi stout, of moderate length, slightly longer than tibia I, indistinctly segmented, truncate at apex. Chelicerae short, needlelike, extending forward to tips of palpi; cheliceral sheaths conspicuous, without striae. *Legs*: Anterior pairs robust, legs I slightly longer than legs II. Leg I with coxa subquadrangular, one and one-half

times as broad as long, without vestiture; femur having length equal to width of coxa or two thirds greatest width of capitulum, slightly longer than broad, inner margin one-half as long as outer margin, sides converging slightly toward apex, segment with three setae; genu two thirds as long as femur, about as broad as long, with four setae; tibia slightly longer than genu, one and one-fourth times as long as broad, with one spinelike seta having length equal to one third basal width of segment located near outer margin at basal third, one narrow, clavate seta with length equal to one half basal width of segment located dorsally beside spinelike seta slightly closer to mid-segment, one clavate seta with length equal to one fourth basal width of segment located just mesad from previous seta, this position being about middorsal on segment, five normal setae; tarsus slightly longer than tibia, twice as long as broad at base, tapering to broadly rounded apex, with one short and one long clavate setae, eight normal setae; tarsus surmounted by a short, narrow pretarsus, its length equal to one half basal width of tarsus, bearing at its apex a large, subcircular empodium and a large curved claw the tip of which projects beyond apex of empodium. Leg II with coxa subtriangular, as broad as long, without setae; femur as long as femur I, outer margin twice as long as inner margin, width of segment equal to length, with three setae; genu one half as long as femur, one and one-third times as broad as long, margins converging slightly toward apex, with four setae; tibia slightly longer than genu, as long as broad, with four setae; tarsus as long as tibia, one and one-half times as long as broad at base, tapering to narrowly rounded apex, with one ovate, annulated seta having length equal to one half basal width of segment, located dorsally near inner margin at basal third, four normal setae; tarsus surmounted by a short pretarsus, its length equal to one third basal width of tarsus, bearing at its apex two large, curved, spreading claws between and beyond which spreads a large, broad, bilobed empodium. Leg III with coxa subtriangular, length equal to combined lengths of femur and genu I, one half as broad as long, outer margin convex, inner margin straight, segment without vestiture; femur three fourths as long as coxa, about one half as broad as long, outer margin three fourths as long as inner margin, segment with one seta; genu about one half as long as femur, as broad as long, lateral margins subparallel, with three setae; tibia one and one-third times as long as genu, one and one-half times as long as broad at base, expanding slightly toward apex, with four setae; tarsus as long as tibia, twice as long as broad at base, tapering to narrowly

rounded apex, with three setae; tarsus terminated by a short, narrow, pretarsal segment, bearing at its apex two stout, curved, spreading claws between and beyond which projects a large, broad empodium, the width of latter equal to width of tarsus at base. Leg IV with coxa subquadrangular, one and one-third times as broad as long, width at base equal to combined lengths of genu and tibia III, with one ventral seta; femur as long as combined lengths of three apical segments of leg III, width at base slightly more than one half length of segment, width at apex one half width at base, outer margin slightly convex, inner margin with a large, smoothly convex expansion beginning at about mid-segment and terminating distally just before apex, width of segment at apical third measured at broadest point of femoral flange equal to two thirds length of segment, three setae on segment; tibia with length equal to one third length of outer margin of femur, with one dorsal, rodlike seta one half as long as segment located near outer margin at apical fourth, one ventral seta longer than leg IV situated near outer margin at apex; tarsus one third as long as tibia, broader than long, with three setae; tarsus surmounted by a large, curved claw, its length equal to three fourths length of tibia, about three times as long as broad at base, apex bluntly rounded. *Genital papilla*: Short and broad, subcordate, with anterior margin emarginate, posterior margin rounded truncate; length, 35μ ; width, 40μ . *Measurements*: Length from tips of palpi to apex of genital papilla, 205μ ; main body suture to apex of genital papilla, 108μ ; anterior margin of propodosoma to main body suture, 61μ ; width of body at point midway between anterior extremities of coxae III and main body suture, 112μ .

Female: Body elongate oval, broadest at mid-length. Anterior apodemes distinct and clearly defined; apodemes I as long as tibia II, extending in posteromedial directions from innermost angles of coxae I, converging medially in line with posterolateral angles of coxae I; apodemes II subparallel to apodemes I for most of their lengths, extending from inner angles of coxae II to median apodeme, intersecting the latter indistinctly at point the basal width of tarsus II anterior to main body suture. Anterior median apodeme extending from V-shaped juncture of apodemes I to main body suture, its appearance indistinct for a short distance at about mid-length and again from point of juncture of apodemes II to main body suture. Posterior apodemes conspicuous; those of legs III extending in anteromedial directions from anterior extremities of coxae III, each apodeme about one half as long as coxa III, their forward extremities

located a distance equal to the length of tibiotarsus I behind main body suture and separated from each other by a distance equal to combined lengths of three apical segments of leg II; apodemes IV slightly longer than apodemes III, extending in anteromedial directions from points one third width of coxa III from inner margins of coxae III at their posterior thirds to points in line with anterior fourths of coxae III, the forward extremities of apodemes being separated from each other by a distance equal to basal width of tarsus II; posterior median apodeme evident only as a short, median, longitudinal line, as long as genu II, extending caudad from point in line with anterior extremities of apodemes III. Hysterosoma with five conspicuous transverse sutures, two transecting body before posterior extremities of coxae III, the other three transecting body in opisthosomal region. Dorsum of propodosoma not projected anteriorly to form a cephalothoracic shield, its anterior margin situated immediately behind capitulum. Pseudostigmatic organs as long as tibiotarsus I, expanded apex subcircular, with diameter equal to three fourths basal width of tibiotarsus I; pedicel short, length equal to one half diameter of expanded apex; basal areolus subcircular, its diameter about equal to one half diameter of expanded apex of organ. Stigmatal openings distinct as sclerotized rings on small elevated dorsal tubercles, situated in line with Y-shaped juncture of apodemes I and median apodeme, separated from each other by a distance equal to combined lengths of femur and genu II; tracheae not clearly defined. *Dorsal chaetotaxy*: Propodosoma with two pairs of dorsal setae; first pair as long as genu I, situated one sixth length of seta anteromesad from stigmatal openings; setae of second pair with length about equal to three fourths width of body at main body suture, located the length of tibia II behind and slightly medial to basal areoli of pseudostigmatic organs. Hysterosoma with six pairs of dorsal setae; first pair three fourths as long as genu II, located one and one-half times length of seta from lateral margins of body, this distance behind main body suture; setae of second pair subequal in length to setae of first pair, located in line with latter, slightly laterad from medial extremities of apodemes III; third pair of setae as long as second pair, located in line with coxae IV, separated from each other by distance equal to distance between bases of femora III; fourth pair of setae slightly longer than setae of second pair, located two thirds length of seta from lateral margins of body, about five times length of seta behind posterior extremities of coxae III; fifth pair of setae as long as genu II, located two and one-half times length of seta behind and medial to setae of third

pair, separated from each other by this distance; sixth pair of setae slightly longer than fourth pair, located one half length of seta from lateral margins of body twice length of seta from apex. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair minute, length equal to one half basal width of tibiotarsus I, located one and one-half times length of seta from median apodeme at points this distance behind anterior extremity of latter; setae of second pair three times as long as setae of first pair, located slightly behind apodemes II at points the length of seta from inner angles of coxae II. Hysterosoma with three pairs of ventral setae; first pair as long as first pair of dorsal hysterosomal setae, situated the length of seta mesad from anteromedial extremities of apodemes III; setae of second pair one and one-half times as long as setae of first pair, located just anterior to caudal extremities of apodemes IV; third pair of setae minute, as long as first pair of ventral propodosomal setae, situated the length of seta from apex of hysterosoma, separated from each other by a distance equal to three times length of seta. *Capitulum*: Length including palpi, 43 μ ; greatest width, 35 μ ; subcordate, with caudal margin rounded truncate, anterior margin truncate. Dorsal setae with length equal to length of tibia II, located near lateral margins, slightly distad from mid-length of capitulum, separated from each other by a distance slightly greater than their combined lengths. Ventral setae as long as but more slender than dorsal setae, located in line with dorsal setae, separated from each other by a distance equal to two thirds length of seta. Palpi short and broad, indistinctly segmented, length equal to length of genu II, width of truncate apex nearly equal to one half length of appendage, with prominent terminal seta near outer margin. Chelicerae needlelike, projecting between and slightly beyond tips of palpi. *Legs*: Anterior pairs short, robust. Leg I with coxa subquadrangular, length equal to two thirds width, three fourths as wide as capitulum, without vestiture; femur length equal to three fourths width of coxa, nearly as broad as long, with one stout, lanceolate seta with length equal to two fifths apical width of segment located dorsally near outer margin at apical fourth of segment and three normal setae; genu nearly as long as femur, one and one-third times as long as broad at base, tapering slightly toward apex, with four setae; tibiotarsus one and two-thirds times as long as genu, twice as long as broad at base, tapering slightly from base to broadly rounded apex, with three specialized sensory setae and twelve normal setae; tibiotarsus surmounted by a broad, subcircular empodium,

its diameter equal to two thirds basal width of tarsus, with tip of long, curved claw projecting beyond its apex. Leg II with coxa subequal in size to coxa I, without setae; femur as long as femur I, with three setae; genu two thirds as long as femur, slightly broader at base than long, tapering slightly toward apex, with one broad, spinelike seta three fourths as long as segment located one half length of seta from outer margin at basal sixth of segment, two normal setae; tibia as long as genu, as broad as long, with four setae; tarsus as long as tibia, one and one-third times as long as broad at base, tapering slightly to broadly rounded apex, with one lanceolate, annulated seta having length equal to one half basal width of segment located near outer margin at basal fifth, one long, tactile seta and three normal setae; tarsus terminated by a short, broad pretarsus, its length equal to one half basal width of tarsus, two thirds as broad as long, bearing at its apex two large, curved, spreading claws between and beyond which projects a large, broad, subcircular empodium. Leg III with coxa narrow, elongate, length equal to combined lengths of genu and tibiotarsus I, two fifths as broad as long, without vestiture; femur as long as tibiotarsus I, basal third bulbous, segment with four setae; tibia nearly as long as femur, one half as broad as long, lateral margins converging slightly from mid-segment toward apex, with four setae; tarsus broad, elongate, two thirds as long as tibia, about two and one-half times as long as broad at base, with four setae; tarsus surmounted by short, broad pretarsus, as long as basal width of tarsus, bearing at its apex two large, curved, spreading claws between and beyond which projects a large, broad empodium. Leg IV with coxa small, subquadrangular, as broad as long, without setae; trochanter small, collarlike, twice as broad as long, without vestiture; third segment slender, elongate, as long as combined lengths of tibia and tarsus III, about eight times as long as broad at base, lateral margins subparallel, one ventral seta with length equal to basal width of segment located near outer margin the length of seta from base, one stout, ventral seta one fourth as long as segment situated near outer margin one half length of seta from apex; fourth segment one half as long as third segment, about six times as long as broad at base, lateral margins subparallel for most of their lengths, with one stout seta as long as segment situated near outer margin at apical fourth, one terminal seta more than one and one-half times as long as leg IV. *Measurements:* Tips of palpi to apex of hysterosoma, 292 μ ; main body suture to apex of hysterosoma, 188 μ ; width of body at anterior extremities of coxae III, 149 μ .

Types: Jamaica, New York, F. A. Sirrine, on leaves of chrysanthemum in greenhouse.

Location of types: U. S. National Museum, slide no. 1132. One male specimen in this cotype series has been encircled by the present writer and is hereby designated lectotype.

Material studied by the present author in addition to the cotype series included specimens accompanied by the following data: Geneva-Sunnydale Nursery, San Francisco, Calif., Sept. 24, 1948, R. E. Beer, cyclamen under glass; Geneva-Sunnydale Nursery, San Francisco, Calif., June 16, 1949, R. E. Beer, ivy under glass; Calif. Evergreen Nursery, San Francisco, Calif., July 7, 1949, R. E. Beer, ivy under glass; Salinas, Calif., Aug. 17, 1949, C. E. Scott, field grown strawberries (var. Lassen); East Malling, Kent, England, June 27, 1949, A. M. Massee and J. R. Gors, strawberry.

After completing studies of European material and evaluating descriptions made by previous authors, this author is convinced that the recognition of *T. fragariae* Zimmerman as a synonym of *S. pallidus* (Banks) is well founded. Most contemporary authors are agreed in this point at the present time although some European workers still interject the name *T. fragariae* into the literature of the present from time to time.

Some limited biological studies of this species by the present author appear to indicate that one reason for expecting the involvement of two distinct species might well be due to the narrow range of environmental tolerances of *S. pallidus*. Although the species frequently causes severe damage to field grown strawberries in the San Francisco Bay area of California, it seldom is found on other outdoor plants which are normally favored as hosts when grown under greenhouse conditions. Another fact worthy of note, and one which has been mentioned by other authors, is that transferral of specimens from one host to another under laboratory conditions seldom meets with success as far as establishing new infestations on the new host is concerned. In spite of the fact that much work has been done on biological studies of this well known economic species, it appears to this author that much has yet to be learned about the ecological requirements of *S. pallidus*.

This species appears to have a definite affinity with other members of the genus, being closer in morphological resemblance to *S. ananas* than to other species in the group. The omnivorous food habit and the unspecialized general body shape as well as other less obvious characters lead this author to believe that *S. pallidus* is perhaps the most primitive species in the genus.

Stencotarsonemus ananas (Tryon), new combination

(Plates 6, 17, and 22)

Tarsonemus ananas Tryon, 1898, Queensland Jour. Agr., vol. 3, no. 6, p. 458; Rutherford, 1913, Trop. Agr. Peradeniya, vol. 41, no. 6, p. 490; Moznette, 1917, Jour. Agr. Res., vol. 10, no. 8, p. 373; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 34; Bianchi, 1940, Proc. Hawaiian Ent. Soc., vol. 10, no. 3, p. 375.

Male: Body elongate, oval, broadest slightly behind main body suture midway between coxae II and III, tapering from coxae III to bluntly rounded apex. Main body suture and posterior body suture distinct. Apodemes of legs I joining median apodeme in line with posterior angles of coxae I, median apodeme extending caudad from point of juncture of apodemes I nearly to main body suture. Apodemes II converging on median apodeme, their median extremities curving abruptly caudad just before joining median apodeme. Apodemes III, IV and posterior median apodemes distinct for their entire lengths, their anterior extremities connected at points about one third distance from main body suture to anterior angles of coxae III, defining four clearly delimited, elongate, connected, interapodemal areas with anterior margin of total area scalloped. *Dorsal chaetotaxy*: Four pairs of setae on propodosoma in linear arrangement; first pair shortest, fourth pair twice as long as first pair and slightly longer than second pair, third pair stout and much longer than others. Four pairs of dorsal setae on hysterosoma. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair minute, length equal to two thirds basal width of tarsus I, located slightly posterior to juncture of apodemes I, twice length of seta from median apodeme; second pair of setae subequal in size to first pair, situated in centers of areas delimited by apodemes II and main body suture. Hysterosoma with two pairs of ventral setae; first pair twice as long as second pair of ventral propodosomal setae, located in apodemal areas of legs III, one half length of seta behind anterior extremities of areas; second pair of ventral hysterosomal setae as long as first pair, situated on apodemes IV at points one third distance from posterior extremities. *Capitulum*: Length, 35 μ ; width, 39 μ ; subcordate, hind margin with a slight medial cleft. Pair of setae situated dorsolaterally on anterior fourth of capitulum, their lengths equal to one third width of capitulum. Ventral setae two thirds as long as dorsolateral setae, situated near inner basal angles of segments. Palpi indistinctly segmented, projecting beyond apex of capitulum. Chelicerae projecting conelike, between palpi, terminating anteriorly in line

with tips of palpi. *Legs:* Anterior pairs subequal in size. Leg I with coxa subtriangular, broader than long, without setae; femur with outer margin one and one-half times as long as breadth of segment, basal half incurved, inner margin as long as breadth of segment, with two dorsal and two ventral setae, all situated near mid-segment; genu as broad as long, slightly tapered toward apex, with four setae; tibia slightly longer than broad, with five normal setae and one long, clavate, sensory seta; tarsus twice as long as broad at base, tapering to bluntly rounded apex, with five normal setae and one stout, clavate seta; tarsus terminated by a broad empodium beyond which projects a single curved claw. Leg II with coxa broader than long; shape and chaetotaxy of femur and genu similar to these segments of leg I; tibia slightly longer than broad, with four setae; tarsus three times as long as basal width, tapering toward apex, with three normal setae and two clavate setae, one as long as basal width of segment the other one half as long; tarsus terminated in a broad, bilobed empodium, projecting beyond large, spreading, curved claws. Leg III with coxa subtriangular, basal breadth one and one-half times length of slightly curved outer margin of segment; femur twice as long as broad, partially divided at about mid-segment by an incomplete suture, segment with two setae; genu nearly as broad as long, sides subparallel, with three setae; tibia one and one-half times as long as broad, sides slightly curved, with four setae; tarsus terminating in a broad, bilobed empodium which projects slightly beyond large, spreading, curved claws. Leg IV with coxa slightly broader than long, lateral margins curved, with one seta; femur two and one-half times as long as broad at base, broadly truncate apex two thirds as broad as basal width of segment; outer margin of segment slightly and uniformly curved, inner margin with broadly rounded flange which joins segment in a smooth curve anteriorly and at an acute angle posteriorly, width of segment at flange equal to three fourths length of segment, conspicuous setae on segment; tibia nearly one and one-half times as long as broad, outer margin convex bent at angle at apical third of segment, inner margin abruptly concave at mid-segment, with two setae, one as long as basal width of segment, broad at base pointed at apex, situated dorsally near outer lateral angle slightly behind tip of segment, the other seta nearly as long as femur IV, very broad at base, situated mid-ventrally on apical third of segment; tarsus small, broader than long, inner margin strongly convex, segment bearing three small setae; tarsus terminates in prominent, broad, curved claw,

bluntly rounded at apex. *Genital papilla*: Length including projecting appendages, 30μ ; greatest width, 32μ ; subcordate, with anterior margin deeply emarginate, posterior margin bluntly rounded. Apex of body projects slightly beyond papilla. *Measurements*: Length from tips of palpi to apex of genital papilla, 213μ ; apex of cephalothoracic shield to tip of genital papilla, 183μ ; tip of shield to main body suture, 68μ ; width of body at main body suture, 90μ ; width of body midway between main body suture and anterior extremities of coxae III, 105μ ; length from main body suture to posterior body suture, 90μ .

Female: Body elongate, oval; main body suture distinct, ventrolateral extremities curved forward; hysterosoma transected by five indistinct sutures, two of which are behind legs IV. Anterior apodemes well defined, those of legs I joining median apodeme opposite inner condyles of coxae I, median apodeme extending posteriorly to point opposite inner condyles of coxae II; apodemes of legs II with anterior extremities at inner coxal condyles of legs II, converging in posteromedial direction, terminating just before juncture at points slightly behind and toward lateral margins from posterior extremity of median apodeme. Posterior apodemes well defined, those of legs III extending from anterolateral extremities of legs III to points slightly laterad from first ventral hysterosomal setae. Leg IV apodemes extending in anterior converging direction from points slightly medial to hind extremities of coxae III to points in line with anterior fourths of coxae III, their forward extremities separated by a distance equal to one half distance between inner angles of coxae IV. Posterior median apodeme absent. Genital cleft located in a distinct ventral plate occupying penultimate segment; sides of plate diverging caudally, anterior margin two thirds as broad as emarginate posterior margin which is as broad as length of penultimate segment of leg IV. Pseudostigmatic organs conspicuous, with short, narrow pedicels supporting broad ovoid termina, pedicels inserted basally on subcircular, sclerotized plates with diameters slightly less than width of expanded apices of organs, located between and dorsad from coxae I and II. Stigmatal openings defined by sclerotized rings situated dorsolaterally in line with anterior angles of coxae I, the width of tarsus I behind anterolateral angles of rostral shield. Tracheae indistinct. *Dorsal chaetotaxy*: Two pairs of dorsal setae on propodosoma; first pair as long as genu II, located on anterolateral angles of rostral shield, slightly laterad from inner angles of coxae II. Hysterosoma with six pairs

of dorsal setae. *Ventral chaetotaxy*: Two pairs of ventral prodorsal setae; first pair with length equal to apical width of tibiotarsus I, located between inner margins of coxae I and juncture of apodemes I; second pair with length subequal to first pair, situated near mid-lengths of apodemes II. Hysterosoma with two pairs of ventral setae; first pair of setae as long as basal width of tibiotarsus I, located half length of seta medial to anterior extremities of apodemes III; second pair of setae subequal in length to first pair, located at hind extremities of apodemes IV. *Capitulum*: Length including projecting palpi, 34μ ; greatest width, 39μ ; broadest at base, tapering slightly to truncate apex, hind margin emarginate. Dorsal setae one half as long as tibiotarsus I, located on lateral margins at anterior fourth of capitulum. Ventral setae as long as width of tibiotarsus I, located the length of seta behind apex of capitulum, separated from each other by a distance equal to length of seta. Palpi indistinctly segmented, with two subapical bristles. Chelicerae converging to conical anterior, projecting forward between palpi and terminating in line with the latter. *Legs*: Anterior pairs short and broad. Leg I with coxa subtriangular, as broad as long, without setae; femur slightly longer than greatest breadth, outer margin curved inward at base, with two dorsal and two ventral setae near mid-segment; genu one and one-half times as long as broad at base, tapering slightly toward apex, with four setae; tibiotarsus two and one-half times as long as broad at base, tapering slightly to truncate apex, with nine normal setae and four clavate, sensory setae; tibiotarsus terminated by a single curved claw projecting beyond broad empodium. Leg II with coxa one and one-half times as broad as long, without setae; femur longer than broad, with two dorsal and one ventral setae; genu as long as broad at base, tapering slightly toward apex, with two normal setae and one broad, lanceolate spine, the latter nearly as long as segment and situated dorsally near base of segment; tibia as broad as long, sides subparallel, with two dorsal and two ventral setae; tarsus one and one-half times as long as broad at base, tapering to rounded apex, with four normal setae and two sensory pegs, the latter located dorsally near base of segment, the one at mid-segment clavate and two thirds as long as basal width of segment, the other close to outer margin of segment, equal in length to clavate seta, broad at base and tapered abruptly to pointed apex; tarsus terminated by two prominent, curved, spreading claws with broad empodium projecting beyond their apices. Leg III with coxa as long as tibiotarsus I,

inner margin straight, outer margin strongly convex, segment without setae; femur nearly four times as long as broad at apex, tapering from apex to basal third, with three setae; tibia nearly three times as long as broad, sides subparallel, with four setae; tarsus slender, elongate, three times as long as broad at base, tapering to narrowly rounded apex, with four setae; tarsus terminating in two strong, curved, spreading claws beyond which projects a broad, medial, single-lobed empodium. Leg IV with coxa subtriangular, broader than long, without setae; trochanter small, collarlike, broader than long, outer margins convex, without setae; third segment narrow, elongate, rodlike, nearly as long as combined lengths of tibia and tarsus III, as broad at base as basal width of tarsus III, with one seta on outer margin having length equal to basal width of segment and located one third length of seta from base of segment, another seta one third as long as segment situated mid-ventrally one third length of seta from apex of segment; fourth segment one third as long as third segment, sides subparallel, apex bluntly rounded, with one ventral seta slightly more than twice as long as segment situated one third length of segment before apex, one long, terminal seta with length more than twice combined lengths of two apical segments of leg. *Measurements*: Length from tips of palpi to apex of hysterosoma, 235 μ ; tip of rostral shield to tip of hysterosoma, 210 μ ; front margin of rostral shield to main body suture, 61 μ ; width of body at main body suture, 101 μ .

Types: South Queensland, Australia, on *Ananas comosus*.

Location of types: Unknown.

Material studied by this writer include specimens from a single collection with the following data: Wahiawa Valley, Oahu, Hawaii, Nov. 1949, Walter Carter, pineapple.

Ewing (1939) did not have male specimens on hand for study at the time of his revision of the group, and, as a result, his acceptance of Tryon's original description of this sex led him to place the species as a possible connecting link between the genus *Tarsonemus* and his new genus *Hemitarsonemus*. This placement of *S. ananas* was made on the basis of the presence of a femoral spur on the inner margin of femur IV of the male, which as this author has pointed out was an erroneous observation of the femoral flange. In general morphological characters *S. ananas* appears to fall between *S. spirifex* and *S. pallidus*.

The species is apparently quite destructive to pineapple, the only recorded host, wherever it is grown. Although not yet recorded

as a pest in pineapple plantings of the continental areas of the Western Hemisphere, it is included in this paper as an aid to identification should it be found in this geographic area at a later date. It is of interest to note that Bianchi (1940) found *Podothrips lucaseni* Krüger to be a natural predator of *S. ananas* in Hawaii, although his mention of *Vallota insularis* (Amaryllidaceae) as the plant host involved leaves some question as to his correctly identifying the mite.

Steneotarsonemus fulgens, new species

(Plates 5, 18 and 22)

Male: Body broad, oval, broadest at anterior condyles of coxae III; legs of moderate length, anterior pairs subequal in size, posterior pairs well-developed. Apodemes conspicuous and well-defined; apodemes I and II subparallel; anterior median apodeme weak for a short distance at point midway between its anterior extremity and main body suture. Posterior apodemes strongly sclerotized; apodemes III and IV subparallel for most of their lengths, apodemes III curving gently inward at anterior thirds, intersecting apodemes IV to form a scalloped anterior margin for interapodemal area, this margin located a distance equal to length of genu I behind main body suture. Cephalothoracic shield with anterior margin broadly truncate, as broad as capitulum. *Dorsal chaetotaxy*: Four pairs of dorsal propodosomal setae in linear arrangement; setae of second pair shorter than others; setae of fourth pair slightly longer than second setae, slightly shorter than setae of first pair; third pair of setae about twice as long as first pair. Four pairs of dorsal hysterosomal setae, those of first pair slightly longer than second and third pairs, fourth pair shortest. *Ventral chaetotaxy*: First pair of ventral propodosomal setae minute, length equal to one half basal width of tarsus I, situated slightly more than length of seta behind apodemes I, this distance laterad from median apodeme. Second pair of ventral propodosomal setae about twice length of first setae, located near centers of areas defined by apodemes II, median apodeme and main body suture. First and second pairs of ventral hysterosomal setae subequal in size, length equal to length of fourth dorsal propodosomal setae; setae of first pair located one third length of seta behind apodemes III at their anterior thirds; setae of second pair situated slightly laterad from apodemes IV at their mid-lengths. *Capitulum*: Subcordate with posterior margin rounded truncate. Dorsal setae with length equal to one half greatest width of capitulum, situated near lateral margins at anterior third of

capsule. Ventral setae half as long as dorsal setae, separated from each other by a distance equal to one and one-half times length of seta. Palpi stout, indistinctly segmented, with angularly truncated apices. Chelicerae styliform, projecting between and beyond palpi; cheliceral sheaths not annulated. Length of capitulum including projecting palpi, 48μ ; greatest width, 38μ . *Legs*: Anterior pairs with lengths nearly equal to width of body at main body suture. Leg I with coxa subquadrangular, broader than long, without vestiture; femur slightly longer than broad, with two setae; genu slightly longer than broad, with four setae; tibia about one and one-third times as long as broad at base tapering slightly toward apex, segment with three normal setae and one short, dorsal, peglike, sensory seta; tarsus twice as long as broad at base, tapering to bluntly rounded apex, with six normal setae, one short, clavate, sensory seta; tarsus surmounted by a short pretarsus bearing a broad empodium and a short, curved claw. Leg II similar to leg I in size and chaetotaxy, except genu has three rather than four setae, tibia lacks a sensory peglike seta and has four normal setae, pretarsus has two curved claws. Leg III with coxa subtriangular, about twice as long as broad, without vestiture; femur about twice as long as broad, partially divided at about mid-length by an incomplete suture, segment with one seta; genu about two thirds as long as femur, with three setae; tibia slightly longer than genu, with four setae; tarsus slender, elongate, tapering from base to narrowly rounded apex, segment with three setae; tarsus bearing at its apex a short, narrow pretarsus which supports two spreading, curved claws and a broad, bilobed empodium. Leg IV with coxa subtriangular, broader than long, with one ventral seta; femur stout, nearly twice as long as broad at base, with a broad quadrangular flange occupying apical three fourths of inner margin, segment with two long and one short setae; tibia nearly twice as long as broad at base, outer margin convex, segment with one stout seta twice as long as segment located ventrally near outer apical margin, one rodlike seta one half as long as segment located dorsally near outer apical margin; tarsus twice as broad as long, with three setae, and bearing at its apex a long, slender, curved claw. *Genital papilla*: Length, 38μ ; greatest width 44μ ; subcordate with posterior margin truncate. *Measurements*: Length from tips of palpi to apex of genital papilla, 244μ ; width of body at anterior condyles of coxae III, 139μ ; anterior margin of cephalothoracic shield to main body suture, 65μ .

Female: Body broad, oval, broadest at mid-length. Apodemes inconspicuous, not clearly defined; apodemes I short and weakly

sclerotized, extending posteromedially from inner condyles of coxae I, intersecting medially at anterior extremity of median apodeme; apodemes II subparallel to apodemes I, extending from inner condyles of coxae II nearly to median apodeme, anterolateral portions of apodemes strongly sclerotized and conspicuous; median apodeme strongly sclerotized from point near anterior extremity to point in line with posteromedial extremities of apodemes II, apparent only as an indistinct line from this point to main body suture. Posterior apodemes indistinct, those of legs III extending anteromedially from anterior condyles of coxae III, becoming indistinct after a short distance; apodemes IV apparent as thin, obscure lines extending anteromedially from anterior condyles of coxae IV for a short distance; posterior median apodeme visible for a short distance at position in line with anterior extremities of apodemes IV. Hysterosoma indistinctly segmented, one suture at coxae IV, one suture midway between coxae IV and apex of body. Pseudostigmatic organs with expanded apices subcircular in outline, narrow pedicel with length about equal to diameter of expanded apex. Stigmatal openings distinct, located slightly behind anterolateral angles of cephalothoracic shield. Tracheae indistinct. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae with length slightly greater than one half length of capitulum, located between stigmatal openings and anterolateral angles of cephalothoracic shield. Second pair of dorsal propodosomal setae about one and one-half times as long as setae of first pair, situated slightly behind and above areoli of pseudostigmatic organs. Five pairs of dorsal hysterosomal setae, first two pairs between coxae IV and main body suture, others on opisthosoma. *Ventral chaetotaxy*: Anterior pair of ventral propodosomal setae with length nearly equal to basal width of tibiotarsus I, situated just behind apodemes I at their mid-lengths. Second pair of ventral propodosomal setae twice as long as setae of first pair, located slightly behind apodemes II at their mid-lengths. First pair of ventral hysterosomal setae subequal in length to second ventral propodosomals, located between anterior extremities of apodemes III and median apodeme. Second pair of ventral hysterosomal setae slightly shorter than those of first pair, located on apodemes IV the length of seta from anterior condyles of coxae IV. *Capitulum*: Subcordate with posterior margin rounded truncate. Length including palpi, 44 μ ; greatest width, 38 μ . Dorsal setae with length equal to one half length of capitulum. Ventral setae nearly as long as dorsal setae. Palpi long, indistinctly segmented, sides subparallel, angularly truncate at apex. Chelicerae styliform, extending to tips

of palpi; cheliceral sheaths not striated. *Legs:* Anterior pairs subequal in size. Leg I with coxa subquadrangular, broader than long, without vestiture; femur slightly longer than broad, with three setae; genu slightly longer than broad at base, tapering from base toward apex, with four setae; tibiotarsus one and one-half times as long as genu, three times as long as broad at base, tapering slightly to broadly rounded apex, segment with twelve normal setae, one long, rodlike seta, two clavate, annulated, sensory setae; tarsus terminating in a short pretarsus bearing a single, strong, curved claw and a broad empodium. Leg II with coxa and femur similar in size and chaetotaxy to those of leg I; genu slightly broader at base than long, with one stout, lanceolate seta located dorsally near inner margin at base, two normal setae; tibia slightly longer than broad, sides subparallel, with four long setae; tarsus as long as tibia, tapering from base to narrowly rounded apex, with four normal setae and one clavate, annulated seta located dorsally near inner margin at basal fourth of segment; tarsus surmounted by a slender, short pretarsus bearing at its apex two long, curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg III with coxa slender, elongate, as long as combined lengths of genu, tibia and tarsus of leg II, segment without ornamentation; femur three fifths as long as coxa, divided at basal third by an incomplete suture, basifemur subcircular in outline, telofemur with sides diverging toward apex, bearing four setae; tibia nearly as long as femur, lateral margins convex, with four setae; tarsus slender, elongate, nearly as long as tibia but one fourth as broad, segment with four setae; tarsus surmounted by narrow pretarsus one third as long as tarsus, bearing two stout, curved, spreading claws and a broad, bilobed empodium. Leg IV with coxa small, subtriangular, as broad as long, without setae; trochanter short, collarlike, broader than long, without vestiture; third segment slightly bowed, as long as combined lengths of femur and genu I, with one seta one fourth as long as segment located ventrally near base on outer margin, one seta one half as long as segment located ventrally near apex on outer margin; fourth segment one half as long as third segment, with subterminal seta slightly longer than segment, terminal seta more than twice as long as segment. *Measurements:* Apex of cephalothoracic shield to tip of opisthosoma, 213 μ ; tip of shield to main body suture, 61 μ ; width of body at main body suture, 139 μ .

Types: Beaver Lake, Washington, July 27, 1950, in eriophyid galls on *Salix* sp.

Location of types: Holotype male, allotype female, two male paratypes, ten female paratypes in Snow Entomological Museum, University of Kansas. Three male and five female paratypes at United States National Museum, Washington, D. C.

At the present time this species is known from a single collection in which they were found to be abundant in galls on willow leaves. The galls also contained many eriophyid mites which probably were responsible for the gall formation. However, it seems apparent that the tarsonemids were feeding on the malformed tissues of the gall rather than upon fungi or other such material.

This species bears a close morphological resemblance to *S. pallidus* from which females may be distinguished by the absence of the strong lanceolate seta of femur I, which is present in *S. pallidus*. Males of these two species are readily distinguished by differences in the size and shape of the femoral flange of leg IV and the chaetotaxy of tarsus I.

Stencotarsonemus chionaspivorus (Ewing), new combination

(Plates 7, 19 and 23)

Tarsonemus chionaspivorus Ewing, 1911, Psyche, vol. 18, no. 1, p. 40; Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 24.

Tarsonemus approximatus Banks, 1914, Jour. Ent. and Zool., vol. 6, no. 2, p. 55; Quayle, 1912, California Agr. Exp. Sta. Bull., 234, p. 503 (*Tarsonemus approximatus* Banks, M. S.); Garman, 1917, Maryland Agr. Exp. Sta. Bull., 208, p. 327.

Tarsonemus floricolus, Ewing, 1939 (not Canestrini and Fanzago, 1876), U. S. Dept. Agr. Tech. Bull., 653, p. 30 (new synonymy).

Male: Body broad, oval, broadest at anterior extremity of coxa III; legs moderately short and stout; all apodemes distinct and well-defined; genital papilla nearly as large as capitulum, slightly longer than broad. Apodemes I as long as tibia I, extending in postero-medial directions from inner condyles of coxae I, converging to form Y-shaped juncture with median apodeme at point slightly posterior to hind extremities of coxae I. Apodemes II twice as long as apodemes I and subparallel to the latter, their medial extremities curving abruptly caudad just before intersection with median apodeme and losing definitly shortly thereafter. Anterior median apodeme distinct for its entire length, extending from Y-shaped juncture of apodemes I to intersection with transverse apodeme. Transverse apodeme strong and distinct, transecting body at point the length of tarsus I behind medial extremities of apodemes II. Posterior apodemes distinct, those of leg III extending in antero-medial directions from anterior extremities of coxae III for a distance

equal to the length of coxa III, curving gently mesad at this point and continuing to intersection with apodemes IV. Apodemes IV subparallel to apodemes III, their anterior extremities curved in a like manner and converging mesally at a point the length of coxa III behind transverse apodeme. Posterior median apodeme well-defined from point of juncture of apodemes IV to a point in line with inner anterior extremities of coxae IV, becoming obscure posterior to this point. A distinct hysterosomal suture transects body at hind extremities of coxae III. Anterior margin of propodosomal shield broadly truncate and projecting to cover basal third of the broad capitulum. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae, the first three pairs in linear arrangement; first pair with length equal to one half greatest width of capitulum, situated one half length of seta behind anterior margin of propodosoma and separated from each other by a distance nearly equal to length of seta; setae of second pair four fifths as long as first setae, situated at points four fifths their length behind and slightly laterad from first setae; third pair of setae slightly longer than propodosoma and three times as long as setae of first pair, situated behind and slightly laterad from setae of second pair a distance slightly greater than that separating first and second setae; fourth pair of setae about as long as setae of second pair, situated laterad and slightly posterior to third setae, separated from the latter by a distance equal to one third length of fourth seta. Hysterosoma with first, second and third pairs of setae subequal in size, slightly longer than first propodosomal setae; fourth pair of dorsal hysterosomal setae one half as long as third pair and located near margins of genital papilla at its mid-length, separated from each other by a distance nearly equal to twice length of seta. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as basal width of tarsus I, located three fourths length of seta laterad from juncture of apodemes I; second pair of setae with size subequal to setae of first pair, situated the length of seta laterad from medial extremities of apodemes II. First pair of ventral hysterosomal setae as long as ventral propodosomals, located near anterior extremity of interapodemal area defined by apodemes III and IV; second pair of ventral hysterosomal setae slightly longer than setae of first pair, located just laterad to apodeme IV, twice length of seta from posterior extremities of apodemes IV. *Capitulum*: Broadly subcordate, with posterior margin rounded truncate and having the suggestion of a slight medial emargination. Length, including projecting palpi, 37 μ ; greatest width, 39 μ . Dorsal setae short, their combined

lengths equal to two thirds width of capitulum, located dorsally on anterolateral margins of capsule. Ventral setae slightly shorter than dorsal setae and occupying a ventral position in transverse line with dorsal setae but more approximate to one another. Palpi short and stout, indistinctly segmented, projecting slightly beyond broadly rounded forward extremity of capitulum. Chelicerae short, styliform, not projecting beyond tips of palpi; cheliceral sheaths without striae. *Legs:* Anterior pairs moderately short and stout, legs I larger than legs II; legs III more slender than anterior pairs; legs IV greatly enlarged. Leg I with coxa rectangular, broader than long, without setae; femur short, nearly as broad as long, with four normal setae; genu as broad as long, with four setae; tibia slightly longer than genu, longer than broad, with one peglike, annulated seta having a length equal to one half basal width of segment, situated dorsally near outer margin at basal third of segment, one short, clavate, annulated seta one-half as long as the former seta, located dorsally near outer margin at mid-segment, five normal setae; tarsus as long as tibia, tapering toward narrowly rounded apex, with one clavate, annulated seta having a length equal to one half basal width of segment, located dorsally one half length of seta from base of segment on its outer margin, seven normal setae; tarsus surmounted by a short, narrow pretarsus bearing a small claw and small empodium. Leg II with coxa subquad-rangular, twice as broad as long, without setae; femur robust, nearly as broad as long, with two setae; genu as broad as long, one half as long as femur, with three setae; tibia three fifths as broad at base as long, with four normal setae; tarsus slender, elongate, tapering from base to narrowly rounded apex, segment as long as tibia, with one short, annulated, sensory seta having length equal to two thirds basal width of segment, located dorsally near inner basal margin of segment, four normal setae; tarsus surmounted by a slender pretarsus with serrated margins, its length equal to two thirds the length of tarsus and bearing at its apex two small, curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa broadly oval, as long as combined lengths of genu, tibia and tarsus II, greatest breadth about one half the length of segment, without vestiture; femur robust, as long as width of coxa, not divided by a suture, with one normal seta; genu short, broader than long, with three setae; tibia about twice as long as broad, tapering slightly from mid-segment to apex, with four setae; tarsus nearly as long as tibia, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by a

slender pretarsus, one half as long as tarsus, and a broad empodium, the pretarsus bearing apically a pair of small, curved, spreading claws. Leg IV with coxa subquadrangular, more than twice as broad as long, with one small ventral seta located near outer margin; femur stout, breadth at base equal to three fifths length of segment, width of apex one third width at base, outer margin of segment strongly convex, segment bearing one dorsal seta having length equal to one and one-half times apical width of segment and situated near outer margin the length of seta from apex of segment, one ventral seta slightly shorter than dorsal seta situated near inner margin at basal two fifths of segment, another ventral seta, twice as long as the former, situated near inner margin one half length of seta from apex of segment; tibia robust, width at base equal to two thirds length of segment, inner margin slightly concave, outer margin slightly convex, with one clavate, annulated, sensory peg, its length equal to two thirds apical width of segment, situated dorsally near outer margin just before apex, one long, tactile seta nearly as long as leg IV, located ventrally at mid-segment near apex; tarsus broader than long, with one ventral seta twice as long as segment, located near inner margin, one dorsal seta with size subequal to ventral seta, situated near inner margin, one short dorsal seta located near mid-segment; leg IV terminated by a long, strong, curved claw, its length equal to length of tibia. *Genital papilla*: Broadly subcordate with rounded anterior margin deeply emarginate; length, 36μ ; width, 36μ . *Measurements*: Length, from tips of palpi to apex of genital papilla, 214μ ; width of body at anterior condyles of coxae III, 122μ ; main body suture to tips of palpi, 77μ ; anterior margin of propodosoma to main body suture, 53μ ; width of body at main body suture, 87μ .

Female: Body broadly oval, broadest at mid-length. Legs relatively small and slender, the anterior pairs subequal in size, legs IV not extending to margins of body and with the innermost margins of their coxae separated by a distance equal to one and one-half times the length of coxa IV. Apodemes weak and inconspicuous, those of legs I as long as genu I, extending in nearly mesad directions from innermost angles of coxae I, converging to form a broad, Y-shaped juncture with the anterior extremity of median apodeme. Apodemes II one and one-half times as long as apodemes I and extending in posteromedial directions from innermost angles of coxae II, terminating at points the width of genu I laterad from median apodeme. Transverse apodeme weak and indistinct, transecting body in a smooth uninterrupted arc slightly

anterior to main body suture, the lateral extremities situated just posterior to the posterior basal angles of coxae II. Anterior median apodeme weak and indistinct extending from point of juncture of apodemes I to point in transverse alignment with mesal extremities of apodemes II. Apodemes III and IV not clearly defined. Posterior median apodeme indicated only as a faint mesal line, situated in transverse alignment with coxae III and approximately as long as coxa III. Dorsum of propodosoma projected anteriorly to form a hood which extends over basal fourth of capitulum, the anterior margin of hood truncate and equal to width of capitulum. Pseudostigmatic organs with expanded apices broadly oval and supported by slender pedicels with length equal to width of expanded apical portion. Stigmatal openings distinct, situated dorso-laterally midway between pseudostigmatic organs and anterolateral angles of hood. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae with length equal to one half width of capitulum, situated one half length of seta behind anterior margin of cephalothoracic hood and separated from each other by a distance nearly equal to their combined lengths; second pair of setae about twice as long as first setae, situated one half length of seta anterior to main body suture, this distance from lateral margins of body. First and second dorsal hysterosomal setae as long as first dorsal propodosomals; third, fourth, fifth and sixth pairs of setae subequal in size, about two thirds as long as first dorsal propodosomals. *Ventral chaetotaxy*: First pair of ventral propodosomal setae as long as basal width of tibiotarsus I, located the length of seta laterad from juncture of apodemes I; second ventral propodosomals twice as long as setae of first pair, situated on apodemes II at about mid-lengths of apodemes. First ventral hysterosomals as long as second ventral hysterosomals, located the length of seta behind main body suture and separated from each other by a distance equal to two and one-half times length of seta; second ventral hysterosomals as long as setae of first pair, located three fourths length of seta from inner margins of coxae III at the posterior two fifths of these segments; third pair of setae one half as long as sixth dorsal propodosomals, located near apex of hysterosoma. *Capitulum*: Relatively small and subcordate, with posterior margin slightly emarginate; length, including projecting palpi, 38μ greatest width, measured at posterior third of capsule, 28μ . Dorsal setae with length equal to two fifths greatest width of capitulum, situated near anterolateral margins of capsule. Ventral setae two thirds as long as dorsal setae, situated near bases of palpi and separated from each other by a dis-

tance equal to length of seta. Palpi relatively long and moderately stout, indistinctly segmented and ornamented. Chelicerae short and styliform, projecting between but not beyond palpi; cheliceral sheaths without transverse striae. *Legs:* Leg I with coxa robust, subquadrangular, slightly broader than long, without vestiture; femur one and one-half times as long as broad, with three setae; genu one and one-half times as long as broad, with four setae; tibiotarsus nearly twice as long as genu, about four times as long as broad at base, with one short, clavate, annulated seta having length equal to one half basal width of segment, located dorsally near outer margin the length of seta from base of segment, one clavate, annulated seta with length equal to basal width of segment, located dorsally near outer margin at about mid-segment, ten normal setae; tarsus surmounted by a short, narrow pretarsus which subtends a small empodium and a curved claw. Leg II with coxa subquadrangular, as broad as long, without vestiture; femur one and one-half times as long as broad, with three setae; genu as broad as long, with three setae; tibia one and one-third times as long as genu, with four setae; tarsus slender, elongate, as long as genu, three times as long as broad at base, tapering to narrowly rounded apex, with one clavate, annulated seta having length equal to basal width of segment, situated dorsally on outer margin near base of segment, four normal setae; tarsus surmounted by a short, slender pretarsus which bears at its apex two small, curved, spreading claws and a small empodium. Leg III with coxa slender, elongate, length equal to combined lengths of genu and tibiotarsus I, about one fourth as broad as long, without vestiture; femur slightly less than one half as long as coxa, with basifemur subglobose and separated from telofemur by a strong constriction and an incomplete suture at basal two fifths of segment, telofemur expanding from its base to apex and with three setae; tibia as long as femur, two and one-half times as long as broad at base, with four setae; tarsus slender, elongate, nearly as long as tibia, with three setae; tarsus surmounted by a short pretarsus having imbricated margins and subtending two small, curved, spreading claws between which projects a small, bilobed empodium. Leg IV with coxa subtriangular, slightly longer than broad, without vestiture; trochanter collarlike, one and one-half times as broad as long, without setae; third segment relatively short and slender, its length about equal to length of femur III, with one ventral seta one third as long as segment, located on outer margin near base, one ventral seta one third as long as segment, situated near outer margin at

apical fifth of segment; fourth segment three fifths as long as third segment, with one stout ventral seta as long as third segment, situated near outer margin at apical third, one terminal seta as long as leg IV. *Measurements*: Length, from tips of palpi to apex of hysterosoma, 206 μ ; anterior margin of cephalothoracic hood to apex of hysterosoma, 177 μ ; anterior margin of hood to main body suture, 52 μ ; width of body at main body suture, 96 μ ; width of body at anterior condyles of coxae III, 107 μ ; width at coxae IV, 107 μ ; distance between anterior condyles of coxae III, 50 μ ; distance between innermost margins of coxae IV, 12 μ .

Types: Originally described from specimens of both sexes collected at Ames, Iowa, July 25, 1910, by H. E. Ewing, on poplar infested with oystershell scale.

Location of types: Unknown.

The description of the male given above was made from a specimen which was remounted from a slide identified with the following data in the handwriting of the author of this species: "*Tarsonemus chionaspivorus* Ewing, male, feeding on eggs of *Coccus longulus*?, Pomona, California, July 2, 1912, Neuls." Since this specimen was identified by its original describer, it seems reasonable to accept this determination as correct, especially since the whereabouts of the type series remains a mystery and so precludes comparison with other specimens. The female description was made from one of the Brooklyn Botanical Garden specimens identified below. Additional material examined by the present author and identified as this species includes specimens with the following data: U. C. greenhouse, Berkeley Calif., Sept. 16, 1949, R. E. Beer, from azalea (one male); Brooklyn Bot. Gardens, N. Y. City, N. Y., Aug. 8, 1934, F. F. Smith, from decaying buds of *Iris kaempferi* (eleven males and twelve females).

This species bears a very close resemblance to *Tarsonemus setifer* but the stout legs and broad capitulum indicate a closer affinity with the genus *Steneotarsonemus*. In the male it can be readily distinguished from members of the Setifer Group of the genus *Tarsonemus*, with which it is easily confused, by its greatly dilated, robust femora IV and by its broad capitulum.

Genus *Hemitarsonemus* Ewing

Hemitarsonemus Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 51.

The characteristics of this genus are redefined as follows: Body of female strongly convex dorsally, male laterally compressed. Female with cephalothoracic shield projected anteriorly covering

most of capitulum. Male with inner margin of femur IV never produced to form a flangelike process, often with subapical spurlike projection; combined tibia and tarsus or tibiotarsus IV slender, elongate, incurved, terminal claw well developed or reduced to a small knob.

Type of genus: *Tarsonemus tepidariorum* Warburton (by original designation).

This genus has been involved in considerable controversy prior to the present writing. The sequence of incidents leading up to the confusion in the genus began with the description of *Acarus translucens* by Nietner in 1861. This mite in the opinion of the present author and in the opinion of Ewing (1939) is not a tarsonemid. In 1890 Green described a tarsonemid mite under the name of *Acarus translucens*, the name obviously being a primary homonym. In 1928 Oudemans erected the new genus *Avrosia* which was accompanied by a very poor description of *Acarus translucens* Green together with the designation of the genotype as being *Acarus translucens* Nietner. In 1904 Banks described as a new species *Tarsonemus latus* which was the same mite as Green's *Acarus translucens*. Although Banks' *T. latus* is a synonym of *A. translucens* Green, the former name is resurrected from synonymy to replace Green's homonym. In 1939 Ewing described the genus *Hemitarsonemus* designating as genotype *Tarsonemus tepidariorum* Warburton with *Tarsonemus latus* Banks as an included species in his new genus. Ewing (1939) was aware of the situation caused by Oudemans' (1928) error and for that reason he used *T. tepidariorum* as the type of his new genus *Hemitarsonemus*.

KEY TO THE SPECIES OF HEMITARSONEMUS

Males

1. Leg IV terminating in a strong, curved claw 2
 Leg IV with terminal claw reduced to a small tubercle *latus*, p. 1293
2. Femur IV with inner margin produced to form a subapical spurlike process; coxa IV with one seta *tepidariorum*, p. 1308
 Femur IV with inner margin not produced to form spurlike process; coxae IV without setae *peregrinus*, p. 1300

Females

1. Tarsus III with claws reduced, exceeded by empodium 2
 Tarsus III with claws well-developed, surpassing empodium, ... *peregrinus*, p. 1300
2. Hysterosoma with one pair of ventral setae situated between coxae IV; tibiotarsus I without empodium *latus*, p. 1293
 Hysterosoma lacking ventral setae situated between coxae IV; tibiotarsus I with empodium *tepidariorum*, p. 1308

Hemitarsonemus latus (Banks)

(Plates 15, 21 and 25)

Tarsonemus latus Banks, 1904, Proc. U. S. Natl. Mus., vol. 32, no. 1553, p. 615; Banks, 1915, U. S. Dept. Agr. Rept., 108, p. 108; Mozzette, 1925, Quar. Bull. State Plant Board, Florida, vol. 9, no. 3, p. 121; Smith, 1933, U. S. Dept. Agr. Cir., 301, p. 1; Smith, 1935, Jour. Econ. Ent., vol. 28, no. 1, p. 91; Marle, 1944, Tijdschr. over Plantenziekten, vol. 50, no. 2, p. 26.

Acarus translucens Green (not Nietner, 1861), 1890, Rept. Govt. Ent. Dept. Agr., Ceylon, Part I, p. 12.

Tarsonemus translucens (Green), Green, 1913, Rept. Govt. Ent. Dept. Agr., Ceylon, Part IV, p. 2; Rutherford, 1913, Trop. Agr. Peradeniya, vol. 41, no. 6, p. 490; Carpenter, 1918, Phytopath., vol. 8, p. 286; Mann et al, 1920, Agr. Jour. India, vol. 15, p. 282; Hirst, 1921, Proc. Zool. Soc. London, vol. 52, p. 797; Hirst, 1923, Proc. Zool. Soc. London, vol. 54, p. 995; Hutson, 1921, Trop. Agr. Peradeniya, vol. 56, no. 6, p. 378; Kulkarni, 1922, Agr. Jour. India, vol. 17, p. 51; Fajardo and Bellosillo, 1934, Philippine Jour. Sci., vol. 54, no. 4, p. 523.

Hemitarsonemus latus (Banks), Ewing, 1939, U. S. Dept. Agr. Tech. Bull. 653, p. 54; Lavoipierre, 1940, Jour. Ent. Soc. Southern Africa, vol. 3, p. 116; Vrydagh, 1942, Publ. Inst. nat. Etude. agron. Congo Belge. Ser. sci., vol. 28, p. 1; Massee, 1943, Rep. East Malling Res. Sta. (1942), p. 64; Gadd, 1946, Bull. Ent. Res., vol. 37, no. 2, p. 157.

Male: Body short, oval, broadest at mid-length; legs long, spindly; apodemes distinct and well-defined; genital papilla prominent, nearly as large as capitulum, apical horns short but conspicuous. Apodemes I slightly longer than half greatest width of capitulum, extending in posteromedial directions from inner angles of coxae I to point of convergence about in line with middles of posterior margins of coxae I. Apodemes II extending in nearly transverse directions from anterior condyles of coxae II to juncture with median apodeme at point the length of apodeme I behind anterior extremity of median apodeme. Anterior median apodeme well-defined for its entire length, extending from Y-shaped juncture with apodemes I to main body suture, apodemes II joining median apodeme at its mid-length. Posterior apodemes dominating hysterosoma; apodemes III extending in anteromedial directions from anterior condyles of coxae III nearly to main body suture, recurved abruptly at this point and converging on median apodeme at its anterior extremity. Apodemes IV subparallel to apodemes III for most of their lengths, joining median apodeme at point the width of tibia II behind anterior extremity of median apodeme. Posterior median apodeme bifurcate posteriorly, each fork more than half length of median portion of apodeme, terminating at inner angles of coxae IV. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae; setae of first pair shorter than others, second pair longest, third and fourth pairs subequal in length. Hysterosoma with five pairs of dorsal setae; first pair slightly longer than third

pair propodosomal setae, situated the length of seta behind main body suture, one fourth length of seta from lateral margins of body; second pair of setae as long as first pair, located the length of seta behind main body suture, separated from each other by a distance equal to twice length of seta; third pair of setae very stout, one and one-fourth times as long as setae of second pair, situated nearly in line with base of fork of median apodeme, separated from each other by a distance equal to one and one-half times length of seta; fourth pair of dorsal hysterosomal setae as long as second pair, located on lateral margins of body about in line with anterior margin of genital papilla; fifth pair of setae very stout, one and one-third times as long as fourth pair, located at apex of hysterosoma at about mid-length of genital papilla, separated from each other by a distance equal to half length of seta. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair as long as basal width of tarsus I, situated the length of seta laterad from Y-shaped juncture of apodemes I and median apodeme; setae of second pair one and one-half times as long as setae of first pair, located midway between apodemes II and main body suture, twice length of seta from median apodeme. Hysterosoma with three pairs of ventral setae, first pair as long as twice basal width of tarsus II, located the length of seta behind main body suture, separated from each other by a distance equal to three times length of seta; second pair of setae one and one-half times as long as setae of first pair, situated near apodemes IV the length of seta mesad from anterior condyles of coxae III; third pair of setae as long as second pair, located near apodemes IV, two thirds length of seta in anteromedial direction from outer basal condyles of coxae IV. *Capitulum*: Subcor-date, posterior margin rounded truncate; length including palpi, 32 μ ; greatest width, 34 μ . Dorsal setae curved, length equal to one fourth greatest width of capitulum, situated near lateral margins at apical third of capitulum. Ventral setae as long as dorsal setae and in transverse line with the latter, separated from each other by a distance equal to three fourths length of seta. Palpi short, stout, indistinctly segmented, subterminal bristles prominent. Chelicerae short, needlelike, projecting beyond tips of palpi. *Legs*: Leg I with coxa broad, quadrangular, nearly twice as broad as long, without setae; femur having length slightly less than width of coxa or slightly more than half greatest width of capitulum, about one and one-half times as long as broad, with three setae; genu one half as long as femur, slightly broader than long, with four setae; tibia about one and one-half times as long as genu and about one and

one-half times as long as broad, with lateral margins somewhat convex, with one short, spinelike seta having length equal to half basal width of segment located dorsally near outer margin the length of seta from base of segment, one clavate, annulated seta with length slightly greater than half basal width of segment located dorsally near outer margin at basal third, one short, clavate, annulated seta with length equal to one third basal width of segment situated immediately beside longer clavate seta and five normal setae; tarsus narrow, elongate, one and one-half times as long as tibia, tapering from base to narrowly rounded apex, with one broad, lanceolate, annulated seta as long as basal width of segment located dorsally near outer margin at basal sixth of segment and seven normal setae; tarsus surmounted by very short, inconspicuous pretarsus, bearing at its apex a small curved claw beyond which projects a broad subcircular empodium. Leg II robust, elongate, with coxa short and broad, about two and one-half times as broad as long, without setae; femur slightly longer than width of coxa, length about equal to width of capitulum, twice as long as broad, with three setae; genu about one half as long as femur, as broad as long, with three setae; tibia about one and one-half times as long as genu, sides subparallel, with four setae; tarsus elongate, nearly twice as long as tibia, broad at base, tapering abruptly to narrow extremity, with one very large, lanceolate, annulated seta slightly longer than basal width of segment located dorsally near inner margin at basal sixth of segment and four normal setae; tarsus surmounted by a narrow pretarsus having length equal to one half basal width of tarsus, bearing at its apex two small, spreading, curved claws and a large, broad empodium. Leg III elongate, robust, with coxa subquadrangular, as long as femur II, without setae; femur as long as combined lengths of femur and genu II, three times as long as broad, lateral margins subparallel for most of their lengths, with two setae; genu nearly one half as long as femur, one and one-half times as long as broad, sides subparallel, with three setae; tibia one and one-half times as long as genu, twice as long as broad at base, slightly expanded toward apex, with four setae; tarsus slightly longer than tibia, broad at base, tapering abruptly, segment appearing slender, elongate, with three setae; tarsus terminating in short, narrow pretarsus bearing two small, curved, spreading claws between and beyond which projects a large, broad empodium. Leg IV with coxa rectangular, as broad as long, two thirds as long as femur III, with one stout seta; femur one and one-half times as long as coxa, twice as long as broad at base,

tapering abruptly to apical third of segment, inner margin of segment with a large subapical spur projecting at nearly a right angle to segment a distance almost equal to half basal width of femur, segment with one dorsal and two ventral seta; tibiotarsus narrow, elongate, incurved sharply at apical third, length equal to two thirds length of femur, width at base about one sixth length of segment, with one long, tactile seta and four short, spinelike setae; tibiotarsus surmounted by small, blunt, buttonlike claw. *Genital papilla*: Length, 24μ ; width, 28μ ; subcircular, with posterior margin flattened truncate; a pair of short, caudolaterally directed, hornlike processes projecting from papilla at extremities of truncated posterior margin. *Anal plate*: Large and well defined; triradiate apodemes with expanse equal to two thirds greatest width of genital papilla, angle formed by posterior apodeme and anterior apodeme greater than a right angle; posterior margin of central disc of plate almost reaching to point in line with anterior margin of genital papilla. *Measurements*: Length from tip of capitulum to apex of genital papilla, 168μ ; main body suture to apex of genital papilla, 100μ ; anterior margin of propodosoma to main body suture, 46μ ; width at main body suture, 93μ ; width of body between coxae II and III, 97μ .

Female: Body broad, oval, broadest at mid-length. Anterior apodemes distinct, those of legs I as long as width of coxa I, converging medially in line with posterior margins of coxae I. Apodemes II one and one-half times as long as apodemes I, intersecting median apodeme at points the length of genu I behind anterior extremity of median apodeme. Median apodeme extending from Y-shaped juncture of apodemes II to main body suture, apodemes II intersecting median apodeme just anterior to mid-length of the latter. Apodemes III nearly as long as coxae III, extending in anteromedial directions from anterior condyles of coxae III, curving slightly with anterior third of their lengths nearly parallel to main body suture, apodemes terminating indistinctly half their length from mid-body, one and one-half times length of apodeme behind main body suture. Apodemes IV slightly longer than apodemes III, subparallel to posterior portions of apodemes III, curved anteriorly at medial extremities which are separated from each other by distance equal to width of coxa III. Posterior median apodeme present only as a very small, crow's-foot structure, located between and slightly behind median extremities of apodemes IV. Hysterosomal sutures indistinct except for suture transecting body at coxae IV. Pseudostigmatic organs slightly shorter than tarsus II, enlarged apex subcircular, its diameter slightly greater than length of slender

pedicel, basal plates two thirds as long as diameter of expanded apex of organ. Stigmatal openings pronounced, located just behind anterolateral angles of propodosoma, diameter of opening equal to one third diameter of apical portion of pseudostigmatic organ; tracheae distinct only for a short distance beyond stigmatal openings; tracheal pouches apparently absent. *Dorsal chaetotaxy*: Propodosoma with two pairs of dorsal setae; first pair stout, length equal to width of femur I, located the length of seta behind anterior margins of propodosoma, separated from each other by a distance nearly equal to combined lengths; setae of second pair weak, two thirds as long as setae of first pair, located twice length of seta from main body suture, this distance from lateral margins of body, about in line with juncture of apodemes II with median apodeme. Hysterosoma with five pairs of dorsal setae; first pair as long as greatest width of femur III, located the length of seta from lateral margins of body, about in line with anterior extremities of apodemes III, this being at about mid-length of first hysterosomal segment; second pair of setae subequal in length to first pair, located at mid-length of first hysterosomal segment, slightly anterior and mesad from anterior coxal condyles of legs III; third pair of setae as long as setae of second pair, situated twice length of seta before penultimate hysterosomal suture, separated from each other by a distance slightly less than distance between anterior condyles of coxae IV; fourth pair of dorsal hysterosomal setae as long as third pair, located on lateral margins of body at base of apical segment of hysterosoma; fifth pair of setae as long as setae of fourth pair, located at apex of hysterosoma, separated from each other by a distance equal to two and one-half times length of seta. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair as long as median width of tibiotarsus I, located one third length of seta behind apodemes I at their median thirds; second pair of setae as long as first pair, situated one half length of setae behind lateral thirds of apodemes II. Hysterosoma with six pairs of ventral setae; first pair with length equal to basal width of tarsus II, located between anterior extremities of apodemes III and main body suture, separated from each other by a distance equal to four times length of seta; second pair of setae slightly longer than setae of first pair, situated on medial extremities of apodemes III; third pair of setae subequal in length to second pair, located at mid-lengths of apodemes IV, these setae and setae of second pair within area delimited by apodemes III and IV; fourth pair of setae slightly longer than setae of second pair, located between coxae IV, separated from each other by a

distance equal to their combined lengths; fifth pair of setae slightly longer than fourth pair, located midway between posterior margins of coxae IV and apex of hysterosoma, separated from each other by a distance equal to two and one-half times length of seta, this distance equal to length of tarsus II; sixth pair of setae slightly longer than setae of fifth pair, located at apex of body, separated from each other by a distance about equal to their combined lengths. *Capitulum*: Length including palpi, 35μ ; width, 33μ subcordate, with posterior margin truncate. Dorsal setae with length equal to one fourth greatest width of capitulum, located on margins of capsule at apical fourth. Ventral setae as long as dorsal setae, situated in region of apical third of capitulum, separated from each other by a distance equal to three fourths length of seta. Palpi robust, broadly rounded apices projecting a short distance beyond tip of capitulum. Chelicerae styliform, projecting between tips of palpi; cheliceral sheaths conspicuous, without striae. *Legs*: Anterior pairs rather small in comparison with size of body. Legs I and II assembled in anterior two thirds of small propodosoma, inner margins of coxae II separated by a distance slightly less than greatest width of capitulum. Leg I of moderate length, about as long as one half width of body at main body suture, with coxa subquadrate and without setae; femur as long as coxa, one and one-third times as long as broad at base, tapering slightly from base to apex, with three setae; genu two thirds as long as femur, as broad at base as long, tapering slightly from base to apex, with four setae; tibiotarsus broad, elongate, one and one-half times as long as femur, three and one-half times as long as broad at base, tapering slightly from base to broadly rounded apex, with one long, annulated seta as long as basal width of segment located near outer margin at basal third, one short, clavate, annulated seta near base of segment on outer margin, one short, lanceolate, annulated seta near base of segment on outer margin and twelve normal setae; tibiotarsus surmounted by a single stout claw, directed at nearly a right angle to tarsus, its length about equal to one fourth length of tarsal segment. Leg II longer than leg I, with coxa subtriangular, slightly broader than long, without setae; femur as long as combined lengths of femur and genu I, about two and one-fourth times as long as greatest breadth, tapering slightly from base to apex, with three setae; genu slightly more than one third as long as femur, about as long as broad, with three setae; tibia one and one-half times as long as genu, sides subparallel, with four setae; tarsus narrow, elongate, tapering abruptly from base, its length one and one-third times length of tibia, four times as long

as broad at base, with one long, dorsal, clavate, annulated seta slightly more than one third as long as segment located near inner margin at base and four normal setae; tarsus surmounted by a short pretarsus, its length equal to one half basal width of segment, bearing at its apex two small, spreading claws between and beyond which projects a broadly rounded empodium. Leg III with coxa broad, elongate, as long as femur II, slightly more than twice as long as greatest breadth, outer margins convex, without vestiture; femur nearly as long as coxa, expanded from base to apex, with five setae; tibia slightly longer than femur, nearly four times as long as broad at base, tapering slightly to apex, with four setae; tarsus narrow, elongate, nearly as long as tibia, lateral margins subparallel, with four setae; tarsus terminated by a short, imbricated pretarsus, as long as basal width of tarsus, bearing at its apex two small, spreading claws between and beyond which projects a broadly rounded empodium. Leg IV with coxa subtriangular, slightly broader than long, width equal to width of coxa III, without setae; trochanter collarlike, twice as broad as long, without setae; third segment narrow, elongate, as long as coxa III, with one ventral seta one fourth as long as segment located near inner margin half length of seta from base, one ventral seta one third as long as segment situated on inner margin one third length of seta from apex of segment; fourth segment narrow, elongate, four fifths as long as third segment, with a stout, subapical seta as long as segment situated on inner margin at apical sixth of segment, apical seta nearly as long as leg IV. *Measurements:* Anterior margin of propodosoma to apex of hysterosoma, 186 μ ; tip of propodosoma to main body suture, 59 μ ; width of body at main body suture, 139 μ ; width at coxae III, 159 μ ; distance between anterior condyles of coxae III, 66 μ .

Types: Washington, D. C., on young shoots of mango in greenhouse.

Location of types: Unknown.

Living specimens of males of this species are rather easily distinguished from any of the known males in previous genera, even with only the low power magnification of a hand lens. The long, spindly hind legs which are carried in a semierect position are quite characteristic and are readily seen. Living females are often a pale or dark green color with a conspicuous longitudinal middorsal stripe in the shape of an hourglass which is white in color.

This species may be readily distinguished from other members of the family Tarsonemidae discussed in this paper by the presence,

in the male, of a ventral hysterosomal seta situated in the inter-apodemal area delimited by apodeme IV and the posterior median apodeme, and in the female, by the presence of an extra pair of ventral hysterosomal setae situated between coxae IV.

The present writer has studied specimens of this species accompanied by the following data: U. C. greenhouse, Berkeley, Calif., Sept. 12, 1941, E. O. Essig, curling leaves of *Vigna sesquipedata*; U. C. greenhouse, Berkeley, Calif., Sept. 19, 1949, R. E. Beer, African marigold; Dacca, India, G. M. Das, on jute; Manilla, P. I., Oct. 22, 1932, T. G. Fajardo, on dahlia; Taihoku, Formosa, Jan. 10, 1939, R. Takahashi, on tobacco leaf; Puerto Rico, Feb. 10, 1939, Arturo Roque, on peppers; Dom. Ent. Lab., Vineland Sta., Ontario, Dec. 14, 1939, G. G. Dustan, on tomato; Belgian Congo, Sept. 25, 1947, R. W. Harned, on cotton leaves; Peamoho, Oahu, Oct. 18, 1940, W. C. Look, papaya; Kailua, Oahu, Feb. 8, 1940, W. C. Look, papaya; Guam, Apr. 28, 1938, R. G. Oakley, on tomato plant; St. Groex, Virgin Is., Dec. 31, 1931, C. E. Wilson; Bahia, Brazil, April 22, 1928, G. Bondar, on *Phaseolus vulgaris*; Campinas, S. Paulo, March, 1938, E. J. Hambleton, on cotton.

The species is a very destructive plant feeder with a rather extensive host range and wide distribution. It is known to occur in Australia, Asia, Africa, Europe, North America, South America and the Pacific Islands.

Hemitarsonemus peregrinus, new species

(Plates 15, 21 and 25)

Male: Body short, diamond-shaped, broadest at about mid-length. Apodemes distinct and clearly defined, those of legs I as long as genu I, extending in posteromedial directions from innermost angles of coxae I converging medially. Apodemes II as long as tarsus I, subparallel to apodemes I for most of their lengths, extending from inner angles of coxae II to about caudal third of median apodeme, curved abruptly in posterior direction at medial fifth of their lengths, terminating indistinctly just laterad from median apodeme the length of genu I in front of main body suture. Anterior median apodeme extending from point in line with hind margins of coxae I to main body suture, its anterior extremity at Y-shaped juncture of apodemes I, posterior half less distinct than anterior half of its length. Apodemes III conspicuous, extending in anteromedial directions from anterior extremities of coxae III in forward directed arc, intersecting apodemes IV at their anterior extremities, antero-medial half of apodemes less distinct than remainder of length.

Apodemes IV linear, extending from outer basal angles of coxae IV to points one half length of genu I laterad from anterior extremity of median apodeme. Posterior median apodeme extending from point one fourth length of genu I behind main body suture to point in line with bases of coxae IV, not bifurcate caudally. Dorsum of propodosoma not prolonged anteriorly to form a cephalothoracic shield, its anterior margin in line with posterior margin of capitulum. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae; first pair about twice as long as tarsus II, located the length of genu I behind anterior margin of propodosoma, separated from each other by this distance; setae of second pair as long as tibia I, located two thirds length of seta behind and slightly laterad from setae of first pair, equidistant from setae of first and third pairs; third pair of setae one and two-thirds times as long as setae of first pair, situated two thirds length of second seta behind and slightly laterad from the latter; setae of fourth pair two thirds as long as setae of second pair, located one half length of seta laterad from and slightly behind setae of third pair. Hysterosoma with four pairs of dorsal setae; first pair slightly more than twice as long as third pair of dorsal propodosomal setae, located near lateral margins of body two thirds the distance from main body suture to anterior extremities of coxae III; second pair of setae as long as tibia III, situated near lateral margins of body about in line with hind extremities of coxae III; setae of third pair one half as long as setae of second pair, located the length of seta from caudolateral margins of body, in line with posterior extremities of coxae IV, separated from each other by a distance nearly equal to three times length of seta; fourth pair of setae as long as third pair, located on caudolateral extremities of hysterosoma, beside apical fourth of genital papilla. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair as long as tibia II, located the length of seta laterad from Y-shaped juncture of apodemes I; setae of second pair subequal in length to setae of first pair, situated the length of seta behind apodemes II, one and three-fourths times length of seta from median apodeme. Hysterosoma with two pairs of ventral setae; first pair as long as genu I, located one and one-fourth times length of seta laterad from anterior extremities of apodemes IV, this being one and one-half times length of seta behind main body suture; setae of second pair one and one-fourth times as long as setae of first pair, situated in interapodemal areas delimited by apodemes III and IV, one third length of seta from apodemes IV at their posterior thirds. *Capitulum*: Subcordate with posterior margin truncate;

length including projecting palpi, 34μ ; greatest width, 27μ . Dorsal setae as long as tibia II, situated near lateral margins at about apical third of capitulum. Ventral setae slightly longer but not as stout as dorsal setae, located very nearly opposite the latter. Palpi short, indistinctly segmented, short subterminal bristles as long as width of palpus at apex. Chelicerae short, needlelike, extending to tips of palpi. *Legs*: Anterior pairs slender, elongate, first pair slightly longer than second pair. Leg I with coxa subquadrangular, nearly twice as broad as long, without setae; femur with length equal to greatest width of capitulum, about twice as long as broad at base, sides subparallel for most of their lengths, with four setae; genu one third as long as femur, slightly broader than long, with four setae; tibia one and two-thirds times as long as genu, with one lanceolate seta one third as long as segment located dorsally near outer margin at mid-segment, one short, clavate seta with length equal to one sixth basal width of segment located slightly mesad to lanceolate seta, four normal setae; tarsus slender, elongate, twice as long as tibia, six times as long as broad at base, tapering slightly to truncate apex, with one clavate, annulated seta located mid-dorsally at basal two fifths, eight normal setae, segment with a short rodlike spur with length equal to one third basal width of segment located ventrally near inner margin at apex; tarsus surmounted by a short pretarsus bearing a broad empodium beyond which projects a stout, curved claw. Leg II with coxa subquadrangular, one and one-half times as broad as long, without setae; femur as long as but slightly more slender than femur I, width at apex slightly more than one third length of segment, with three setae; genu one third as long as femur, as broad as long, with three setae; tibia one and one-half times as long as genu, one and one-half times as long as broad, with four setae; tarsus slender, elongate, as long as tarsus I, four times as long as broad at base, with one large, ovate, annulated seta having length equal to three fourths basal width of segment located middorsally one half length of seta from base, four normal setae, segment with a short, rodlike spur with length equal to one third basal width of segment situated near inner margin at apex; tarsus surmounted by a short pretarsus, its length equal to one half basal width of tarsus, bearing at its apex two large, curved, spreading claws between and beyond which projects a broad, subcircular empodium. Leg III with coxa slender, elongate, length equal to combined lengths of femur and genu I, one third as broad as long, without vestiture; femur as long as tarsus II, three times as long as broad, basal two fifths expanded

bulbous, lateral margins diverging from basal two fifths to apex, with one seta; genu as long as genu II, as broad as long, with three setae; tibia two and one-fourth times as long as genu, lateral margins subparallel, with four setae; tarsus slender, elongate, one and one-half times as long as tibia, tapering from base to narrowly rounded apex, with three setae and one short, rodlike spur having length equal to one third basal width of segment located near outer margin at apex; tarsus surmounted by a short pretarsus, its length equal to basal width of tarsus, bearing at its apex two large, spreading, curved claws between which projects a broad, subcircular empodium. Leg IV with coxa subtriangular, one and one-third times as long as broad, length equal to length of tibia I, without setae; femur slender, elongate, its length equal to combined lengths of three apical segments of leg I, greatest width about one fifth length, outer margin slightly convex for basal two thirds, inner margin deeply concave at apical fourth the remainder subparallel to outer margin, with one dorsal seta having length equal to three fourths apical width of segment located near outer margin the length of seta from apex, one ventral seta as long as dorsal seta located near inner margin one and two-thirds times length of seta from base, one stout ventral seta two fifths as long as segment located near outer margin at apical third; tibia one third as long as femur, three times as long as broad at base, outer margin straight for most of its length, curved inward the distal width of segment before apex, inner margin deeply concave, one stout seta as long as segment located ventrally near outer margin at apex, one minute peglike seta with length equal to one third apical width of segment located dorsally on outer margin the length of seta from apex of segment; tarsus as long as apical width of tibia, as broad as long, with one minute dorsal seta one third as long as segment located near inner margin at mid-segment, one small seta with length equal to one third length of segment located ventrally near inner margin at mid-segment; tarsus surmounted by long, slightly curved, pointed claw one and one-half times as long as tarsus, about four times as long as broad at base. *Genital papilla*: Length, 26μ ; width, 28μ ; subquadrangular, with anterior margin emarginate, two prominent, short horns projecting from posterolateral angles. *Measurements*: Length from tips of palpi to apex of genital papilla, 149μ ; main body suture to apex of genital papilla, 81μ ; greatest width of body, 118μ .

Female: Body elongate oval, broadest at mid-length. Apodemes distinct and clearly defined, those of legs I as long as genu I, ex-

tending in posteromedial directions from innermost angles of coxae I, converging medially at anterior extremity of median apodeme. Apodemes II one and one-half times as long as apodemes I, subparallel to latter, extending from anteromedial condyles of coxae II to points half length of apodeme from median apodeme at point midway between anterior extremity of the latter and transverse apodeme. Transverse apodeme transecting body at main body suture, its medial portion with anteriorly directed indentation, the truncate anterior margin of indentation as long as genu I. Anterior median apodeme conspicuous from V-shaped juncture of apodemes I to point in line with posteromedial extremities of apodemes II, continuing caudad from this point as a faint line to juncture with forward projection of transverse apodeme. Apodemes III as long as apodemes II, extending in anteromedial directions from forward extremities of coxae III, their posterolateral extremities thickened, anterior fifths curved at nearly right angles toward posterior, these extremities situated the length of genu I laterad from tips of anterior forks of median apodeme. Apodemes IV subequal in length to apodemes III, extending in anteromedial directions from points one half length of genu I mesad from inner margins of coxae III at their posterior thirds to intersection with median apodeme at point in line with anterior extremities of coxae III, the apodemes with a slight thickening at caudal extremities and at mid-lengths and becoming indistinct a short distance before intersection with median apodeme. Posterior median apodeme extending from point in line with caudal extremities of coxae III to point nearly in line with anterior extremities of these coxae, bifurcate at this point, each fork extending anterolaterally a distance equal to basal width of tarsus II, terminating the length of tibia III behind transverse apodeme. Hysterosomal sutures indistinct, one transecting body two thirds the distance from main body suture to anterior extremity of posterior median apodeme, one transecting body at posterior extremities of coxae III, one at anterior half of opisthosoma, one at posterior fourth of opisthosoma. Pseudostigmatic organs three fourths as long as tarsus II, expanded apex subcircular with diameter equal to one half length of organ, pedicel short, slender, basal ring with diameter equal to two thirds diameter of enlarged apex. Stigmatal openings indistinct, located immediately mesad from second pair of dorsal propodosomal setae; tracheae extending in medial direction from openings, forming two U-shaped, thickened, tubular pouches which occupy area near juncture of apodemes II with median apodeme, tracheae indistinct posterior to these

thickenings. Dorsum of propodosoma extended anteriorly forming a sharply pointed cephalothoracic shield the forward extremity of which is located one half length of tarsus II anterior to first pair of dorsal propodosomal setae, shield projecting over three fourths of capitulum. *Dorsal chaetotaxy*: Propodosoma with two pairs of dorsal setae; first pair as long as leg I, situated the length of tarsus III behind and laterad from anterior extremity of propodosoma, separated from each other by a distance equal to one half greatest width of capitulum; setae of second pair more than twice as long as setae of first pair, situated a distance slightly greater than the length of tarsus III behind and laterad from setae of first pair. Hysterosoma with six pairs of dorsal setae; those of first pair as long as tibiotarsus I, situated on lateral margins of body one half length of seta behind main body suture; second pair of setae with length subequal to first pair, located one and one-third times length of seta from lateral margins of body, slightly behind setae of first pair; third pair of setae one half as long as first pair, situated twice length of seta from lateral margins of body, one half length of seta anterior to penultimate hysterosomal suture, separated from each other by a distance equal to five times length of seta; fourth pair of setae subequal in length to setae of first pair, located on lateral margins of body, one half length of seta posterior to penultimate hysterosomal suture; fifth pair of setae subequal in length to setae of fourth pair, located one third length of seta anterior to last hysterosomal suture, separated from each other by a distance equal to length of seta; sixth pair of dorsal hysterosomal setae slightly smaller than setae of fourth pair, situated on caudolateral margins of body, separated from each other by a distance equal to one and one-third times length of seta. *Ventral chaetotaxy*: Propodosoma with two pairs of ventral setae; first pair with length equal to one half length of genu I, located one half length of seta behind apodemes I at their anterior thirds; second pair of setae twice as long as first pair, situated slightly behind apodemes II at anterolateral fourths. Hysterosoma with three pairs of ventral setae; first pair as long as genu I, located the length of seta anterior to and slightly medial from most forward extremities of apodemes III, this being one and one-half times length of seta behind first hysterosomal suture, setae separated from each other by a distance equal to three times length of seta; second pair of setae one and one-half times as long as setae of first pair, located on apodemes IV near their posterolateral extremities; setae of third pair slightly longer than setae of second pair, located near lateral margins of

apical segment of hysterosoma, separated from each other by a distance equal to three times length of seta. *Capitulum*: Length including palpi, 40μ ; width, 35μ ; subcordate, with posterior margin rounded truncate. Dorsal setae as long as genu I, located on lateral margins at apical sixth of capsule, separated from each other by a distance equal to length of seta. Ventral setae slightly shorter than dorsal setae, located near outer basal margins of palpi, separated from each other by a distance equal to twice length of seta. Palpi short, broad at base, curving inward toward broadly rounded apex, indistinctly segmented, length equal to length of genu I, one half as broad at base as long; subterminal bristles with length equal to one half basal width of appendage. Chelicerae short, styliform, projecting forward to tips of palpi; cheliceral sheaths with minute punctures. *Legs*: Anterior pairs of moderate length, first pair slightly longer than second pair. Leg I with coxa subquadrangular, about one and one-half times as broad as long, width equal to one half greatest width of capitulum, without vestiture; femur having length equal to width of coxa, nearly as broad as long, tapering slightly toward apex, with three setae; genu about one half as long as femur, slightly broader at base than long, tapering toward apex, with four setae; tibiotarsus slenger, elongate, about as long as combined lengths of femur and genu, slightly more than one fourth as broad as long, with one spinelike seta having length equal to one half basal width of segment located dorsally near outer margin the length of seta from base, one clavate, annulated seta with length equal to one third basal width of segment located dorsally near outer margin at apical third and ten normal setae; tarsus surmounted by a short pretarsus, its length equal to one half basal width of tarsus, bearing at its apex a large, broad, subcircular empodium beyond which projects a strong, curved claw. Leg II with coxa subquadrangular, one and one-third times as broad as long, without setae; femur as long as femur I, one and one-third times as long as broad at base, tapering toward apex, with three setae; genu one third as long as femur, one and one-half times as broad as long, tapering slightly toward apex, with three setae; tibia one and one-fourth times as long as genu, slightly longer than broad, lateral margins subparallel, with four setae; tarsus about twice as long as tibia, three times as long as broad at base, tapering to broadly rounded apex, with one short, oval, annulated seta having length equal to one half basal width of segment situated dorsally near inner margin slightly proximad

from mid-segment, one short, rodlike seta with length equal to one half basal width of segment located mid-ventrally at apex, five normal setae; tarsus surmounted by a short pretarsus, its length equal to one half basal width of tarsus, bearing at its apex two large, spreading, curved claws between and beyond which projects a broad, subcircular empodium. Leg III with coxa elongate, broad, length equal to combined lengths of tibia and tarsus II, nearly one half as broad as long, without vestiture; femur as long as coxa, lateral margins slightly divergent from basal third toward apex, proximal portion of segment expanded, segment with four setae; tibia as long as femur, two and one-fourth times as long as broad at base, tapering slightly toward apex, with four setae; tarsus broad, elongate, two thirds as long as tibia, nearly four times as long as broad at base, lateral margins subparallel, with four setae; tarsus surmounted by short, broad, tapering pretarsus, bearing at its narrow apex two large, curved, spreading claws between and beyond which projects a broad, subcircular empodium. Leg IV with small, subtriangular coxa, about one and one-half times as broad as long, without vestiture; trochanter collarlike, nearly twice as broad as long, without setae; third segment narrow, elongate, nearly as long as combined lengths of tibia and tarsus III, about five times as long as broad at base, lateral margins tapering very slightly toward apex, with one ventral seta one fourth as long as segment located on outer margin two thirds length of seta from base of segment, one stout, lanceolate seta nearly one half as long as segment situated ventrally near outer margin the apical width of segment before apex; fourth segment one third as long as third segment, lateral margins subparallel to apical third, outer margin converging on inner margin distad from this point, with one stout, lanceolate seta one and two-thirds times as long as segment located ventrally near outer margin at about mid-segment, terminal seta about as long as leg IV. *Measurements:* Length from tips of palpi to apex of hysterosoma, 280 μ ; anterior extremity of propodosoma to apex of hysterosoma, 270 μ ; tip of propodosoma to main body suture, 59 μ ; width of body at main body suture, 114 μ ; width at anterior extremities of coxae III, 188 μ ; distance between anterior extremities of coxae III, 61 μ .

Holotype: Male, Ft. Pierce, Fla., Sept. 10, 1947, M. R. Osburn, on orange leaves.

Allotype: Female, Ft. Pierce, Fla., Sept. 12, 1945, Osburn and Stahler, orange leaves.

Paratypes: One male and one female (plesiotypes), same data as allotype; two females (plesiotypes), same data as holotype (both specimens on same slide, which also contains one male); three males and three females, same data as allotype; one male, same data as holotype; two females, Ft. Pierce, Fla., Feb. 12, 1947, orange leaves, M. R. Osburn.

Location of types: Holotype, allotype and plesiotypes in Snow Entomological Museum, University of Kansas. Remaining paratypes at United States National Museum, Washington, D. C.

Additional specimens identified as this species are accompanied with the following data: Hummock Grove (Crosby), Citra, Fla., Oct. 17, 1951, M. H. Muma (two males and one female); Bamboo-Leesburg, Fla., Nov. 22, 1951, M. H. Muma, under orange leaves (two males and four females); Orange Co., Fla., Dec. 29, 1951, N. A. Walker, orange (two males and seven females); Deland, Volusia Co., Fla., Dec. 29, 1951, N. A. Walker, on orange leaves (six males and four females).

Males of this species are rather easily distinguished from males of the two other species in the genus by the absence of a spurlike projection of the inner margin of femur IV. The reduced claw of leg IV of this sex seems to indicate a closer affinity with *H. latus*, although the strong claws of legs III in the female are more like the female of *H. tepidariorum* than *H. latus*.

Correspondence with M. R. Osburn, who collected the type material, has brought to light the following information. Living specimens have the anterior part of the body colored jet black. They appeared to be numerous on orange trees only during certain periods of the year. No damage to the host plant was noticeable, and from this observation Osburn concluded that the mites were probably predaceous. Specimens collected by Walker were reported to be amber-colored in life.

Hemitarsonemus tepidariorum (Warburton)

(Plates 16, 21 and 25)

Tarsonemus tepidariorum Warburton, 1904, Jour. Roy. Agr. Soc. England, vol. 65, p. 285; Moznette, 1917, Jour. Agr. Res., vol. 10, no. 8, p. 373; Cameron, 1925, Ann. Appl. Biol., vol. 12, no. 1, p. 93.

Hemitarsonemus tepidariorum (Warburton), Ewing, 1939, U. S. Dept. Agr. Tech. Bul. 653, p. 52; Pritchard, 1951, California Agr., vol. 5, no. 7, p. 10.

Male: Body short, oval, broadest at anterior condyles of coxae III. Legs long, spindly, anterior pairs subequal in size. Apodemes conspicuous and well-defined; those of legs I as long as genu I, extending posteromedially from anterior basal angles of coxae I to

juncture with anterior extremity of median apodeme. Apodemes II subparallel to apodemes I extending from anterior basal condyles of coxae II almost to median apodeme. Anterior median apodeme well-defined from anterior extremity to point in line with median extremities of apodemes II, becoming less distinct from this point to its posterior extremity at main body suture. Apodemes III extending from anterior condyles of coxae III in anteromedially directed arcs intersecting apodemes IV and median apodeme slightly behind main body suture. Apodemes IV straight, extending from outer basal condyles of coxae IV in anteromedial directions to juncture with apodemes III. Posterior median apodeme distinct for its entire length, extending from point in line with anterior margins of coxae IV to point the length of genu I behind main body suture, two forks branching from median apodeme just before its posterior extremity and extending to inner basal angles of coxae IV. *Dorsal chaetotaxy*: Propodosoma with four pairs of dorsal setae; those of anterior pair as long as capitulum, situated one third length of seta behind anterior margin of cephalothoracic shield, separated from each other by a distance equal to half length of seta. Second pair of setae minute, less than one fourth as long as setae of first pair, situated two thirds length of capitulum behind and slightly laterad from setae of first pair. Third pair of setae three times as long as setae of first pair, situated behind and slightly laterad from second setae a distance slightly less than distance between first and second setae. Fourth pair of setae slightly shorter than setae of first pair, located one half length of seta laterad from setae of third pair and slightly behind third setae. Hysterosoma with four pairs of dorsal setae; those of first pair three fourths as long as first propodosomals and not as stout, located near lateral margins of body one half length of seta behind main body suture. Second and third pairs of dorsal hysterosomal setae subequal in length, nearly twice as long as first propodosomals. Fourth pair of setae as long as first propodosomals, located near hind margin of body at apical third of genital papilla. *Ventral chaetotaxy*: First ventral propodosomal setae small, length equal to width of genu I, located the length of seta laterad from Y-shaped juncture of apodemes I and median apodeme. Second pair of setae one and one-half times as long as setae of first pair, situated near centers of areas delimited by apodemes II and main body suture. First ventral hysterosomal setae as long as second ventral propodosomals, located slightly mesad from apodemes III at their anterior thirds. Second ventral hysterosomal setae slightly longer than setae of first pair, located

one third length of seta laterad from posterior thirds of apodemes IV. *Capitulum*: Slender, subcordate, with posterior margin rounded truncate. Length including projecting palpi, 33μ ; greatest width, 23μ . Dorsal setae with length equal to one third length of capitulum, located on lateral margins at apical third. Ventral setae slightly shorter than dorsal setae, situated at apical third of capitulum. Palpi short, stout, indistinctly segmented, tuberculate apically. Chelicerae short; cheliceral sheaths not striated. *Legs*: Leg I with coxa subquadrangular, as broad as long, without setae; femur twice as long as broad, sides subparallel, with three setae; genu nearly as broad as long, with four setae; tibia slightly longer than genu, with one slender, rodlike, annulated seta nearly as long as basal width of segment, located middorsally at basal fifth, one stout, spinelike seta as long as annulated seta located dorsally near outer margin at basal fourth, five normal setae; tarsus slightly longer than tibia tapering to bluntly rounded apex, with one short, rodlike, annulated seta as long as basal width of segment located dorsally at basal fourth, seven normal setae; tarsus surmounted by a short, narrow pretarsus bearing at its apex a stout, curved claw and a broad empodium. Leg II with coxa and femur similar in size and chaetotaxy to these segments in leg I; genu as broad as long, with three setae; tibia one and one-third times as long as broad, with four setae; tarsus slender, elongate, tapering from base to bluntly rounded apex, with one broad, annulated seta nearly as long as basal width of segment, located dorsally near outer margin at basal fifth, four normal setae; tarsus surmounted by a short, narrow pretarsus bearing at its apex two curved, spreading claws and a broad, bilobed empodium. Leg III with coxa twice as long as broad, length equal to combined lengths of tibia and tarsus II, without vestiture; femur slender, elongate, as long as coxa, three times as long as broad, with one seta; genu slightly longer than broad, with three setae; tibia one and one-half times as long as genu, sides subparallel, with four setae; tarsus as long as tibia, tapering to narrowly rounded apex, with three setae; tarsus surmounted by a short pretarsus bearing two spreading, curved claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa narrow, subquadrangular, longer than broad, with one ventral seta; femur about twice as long as broad, basal two thirds of segment with broad inner margin terminating in a spur, segment narrow distad from spur, with two small and one stout setae; tibia slender, elongate, two thirds as long as femur, segment bowed inward at apical fourth, with one subapical, rodlike, annulated seta, one long, subapical,

tactile seta; tarsus small, inconspicuous, broader than long, with three small setae; tarsus surmounted by a strong, slightly curved, slender, blunt claw, its length about equal to one half length of tibia. *Genital papilla*: Large and well defined; subcordate with posterior margin truncate; length 37μ ; width 38μ . *Measurements*: Length from tips of palpi to apex of genital papilla, 170μ ; anterior margin of cephalothoracic shield to main body suture, 59μ ; main body suture to hind extremity of genital papilla, 87μ ; width of body at anterior extremities of coxae III, 110μ .

Female: Body broad, oval, broadest at anterior condyles of coxae III. Apodemes conspicuous and well-defined, those of legs I as long as genu I, extending in posteromedial directions from inner condyles of coxae I, converging medially to form Y-shaped juncture with median apodeme; apodemes II subparallel to and twice as long as apodemes I, extending from anterior basal angles of coxae II almost to median apodeme; anterior median apodeme strong and distinct, extending from juncture of apodemes I almost to main body suture, its posterior extremity a short distance behind converging extremities of apodemes II; apodemes III short, curved, extending in arcs from anterior condyles of coxae III nearly to mid-body, distinct only in lateral halves of lengths; apodemes IV weak, straight, extending in anteromedial directions from anterior condyles of coxae IV a distance equal to length of tibiotarsus I, their anterior extremities separated from each other by a distance equal to length of apodeme; posterior median apodeme weak, indistinct, extending from point in line with anterior extremities of apodemes III to point in line with their posterior extremities. Hysterosomal segmentation indistinct except for a prominent suture transecting body just posterior to coxae IV! Pseudostigmatic organs slightly shorter than tarsus II, their expanded apices subcircular, with diameters equal to one half basal width of tibiotarsus I. Stigmatal openings pronounced, situated near dorsolateral margins of propodosoma just anterior to base of cephalothoracic hood, this narrow hood joining broad portion of propodosoma at point in line with bases of pseudostigmatic organs. Conspicuous, circular tracheal pouches present in medial position between stigmatal openings. *Dorsal chaetotaxy*: First pair of propodosomal setae quite strong, with length equal to width of capitulum, located just behind anterolateral angles of cephalothoracic shield nearly the length of seta anterior to stigmatal openings. Second pair of propodosomal setae twice as long and not as stout as setae of first pair, located on dorsolateral margins of body midway between stigmatal openings and main body suture. First pair of

dorsal hysterosomal setae with length equal to length of tibia II, located near lateral margins of body the length of seta behind main body suture. Second dorsal hysterosomal setae like setae of first pair, situated slightly more than length of seta behind main body suture midway between lateral margins of body and mid-body. Third pair of setae slightly shorter than second pair, located twice length of seta anterior to hysterosomal suture, three times length of seta from mid-body. Fourth pair of setae stout, as long as first pair, located near apex of hysterosoma, setae separated from each other by a distance equal to three times length of seta. *Ventral chaetotaxy*: First pair of propodosomal setae nearly as long as genu I, located the length of seta laterad from anterior extremity of median apodeme. Setae of second pair one and one-half times as long as first setae, located on apodemes II at their lateral thirds. First hysterosomal setae as long as first propodosomals, located at anterior extremities of apodemes III, setae separated from each other by a distance equal to twice length of seta. Second ventral hysterosomal setae as long as setae of first pair located in line with apodemes IV at their mid-lengths. Remaining pair of ventral hysterosomal setae short, situated normally at apex of opisthosoma. *Capitulum*: Narrow, subcordate; length including palpi, 36 μ ; greatest width, 26 μ . Dorsal setae with length equal to one third length of capitulum, located on dorsolateral margins of capsule at anterior third. Ventral setae as long as dorsal setae, situated near bases of palpi slightly behind dorsal setae. Palpi short, robust, indistinctly segmented, projecting slightly beyond apex of capitulum. Chelicerae normal; cheliceral sheaths not striated. *Legs*: Anterior pairs rather short and stubby, first pair slightly more robust than second pair, noticeable especially in the broad tibiotarsus I compared to the slender tarsus II. Leg I with coxa subquadrangular, broader than long, without setae; femur three fourths as broad as long, inner margin one half as long as outer margin, segment with two normal setae and one broad, lanceolate, dorsal seta situated at about mid-segment; genu slightly broader than long, with four setae; tibiotarsus robust, slightly more than twice as long as broad at base, tapering gently to broadly rounded apex, segment with one slender, annulated seta with length equal to one half basal width of segment located dorsally near outer margin at apical two fifths, fourteen normal setae, a broad, ventral spurlike, transverse projection just before apex of segment extending from ventral surface; tibiotarsus surmounted by a short, broad pretarsus bearing at its apex a broad, circular empodium and a short, stout, curved claw.

Leg II with coxa subquadrangular, slightly broader than long, without vestiture; femur similar in size and shape to femur I, with three normal setae; genu slightly broader than long, with three setae; tibia slightly longer than broad, with four setae; tarsus twice as long as broad at base, tapering to narrowly rounded apex, with four normal setae, one clavate, annulated seta with length equal to two thirds basal width of segment, located dorsally near inner margin at basal fifth of segment, one small ventral spur projecting from inner apical margin of segment; tarsus surmounted by a short pretarsus bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad empodium. Leg III with coxa slender, elongate, as long as combined lengths of femur and genu I, one third as broad as long, without vestiture; femur three fourths as long as coxa, basal third expanded, bulbous, partially separated from apical portion of segment by a constriction and incomplete suture, distal two thirds of segment with sides diverging slightly toward apex, three setae all situated on telofemur; tibia slender, elongate, nearly as long as femur, with four setae all situated on apical half of segment; tarsus slender, elongate, two thirds as long as tibia, tapering to narrowly rounded apex, with three setae and a short, ventral, terminal spur; tarsus surmounted by a short pretarsus bearing at its apex two strong, curved, spreading claws between and beyond which projects a broad empodium. Leg IV with coxa subtriangular, as broad as long, without vestiture; trochanter short, collarlike, without setae; third segment slender, elongate, sides converging from base to mid-segment, subparallel distad from this point, proximal seta weak, one third as long as segment, situated ventrally near outer margin at basal fourth of segment, distal seta strong, two thirds as long as segment, situated ventrally near outer margin at apical fourth; fourth segment two thirds as long as third segment, proximal seta similar to distal seta of third segment, located ventrally at apical two fifths, terminal seta short, its length slightly exceeding length of terminal segment. *Measurements*: Anterior margin of propodosoma to apex of hysterosoma, 243 μ ; tip of propodosoma to main body suture 78 μ ; width of body at anterior condyles of coxae III, 156 μ ; distance between anterior condyles of coxae III, 70 μ .

Types: England, Sept. 1903, on fern plants in greenhouse.

Location of types: Possibly at Zoological Laboratory, Cambridge, England.

This mite species is commonly known as the fern mite because of

the serious damage inflicted upon ferns of various species. Originally described from specimens found damaging greenhouse ferns in England in 1904, it has subsequently been recorded from greenhouse ferns in Minnesota and California. An excellent account of its biology is given by Cameron (1924) and some biological information worthy of note has been published by Pritchard (1951).

Recorded hosts of this mite include several species of *Pteris*, *Asplenium bulbiferum* and *Polystichum* sp. Typical damage usually includes leaf deformities and stunting of plants very similar to the type damage inflicted by *H. latus* and *S. pallidus*.

Specimens examined by the present writer are identified with the following data: University of Minnesota, April 17, 1929, holly fern; Plath Nursery, San Francisco, California, March 15, 1951, A. E. Pritchard, on *Pteris* sp.

Genus *Xenotarsonemus*, new genus

This genus is characterized in the males by having leg IV with three segments, coxa, femur and tibiotarsus, the latter expanded bulbously at tip, bearing a stout, curved spine on outer margin near base, one long, stout, apical seta and two short, apical setae; femur with inner margin produced into a small spurlike process; tibiotarsus I with a long, broad seta more than one half as long as segment, located near outer margin at base. Females with cephalothoracic shield projecting forward and covering most of capitulum; legs IV never extending to caudolateral margins of body; inner margins of coxae IV separated by a distance less than width of coxa.

Type of genus.—*Tarsonemus viridis* Ewing.

This genus is here proposed to include the single species designated as genotype. *T. viridis*, at the time of its original description by Ewing (1939), was recognized by him to be distinctive enough to suggest possible removal to a new genus. As indicated earlier in this paper, the present writer feels that in this species is found the culmination of specialization in the family Tarsonemidae as presently constituted.

Xenotarsonemus viridis (Ewing), new combination

(Plates 14, 21 and 25)

Tarsonemus viridis Ewing, 1939, U. S. Dept. Agr. Tech. Bull., 653, p. 35.

Male: Body broadly oval, broadest just behind main body suture; legs rather long and stout, the anterior pair conspicuously longer than legs II; apodemes moderately strong and well-defined; genital papilla of medium size, smaller than capitulum. Apodemes I

slightly longer than genu I, extending in posteromedial directions from anterior basal angles of coxae I, converging medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II about twice as long as apodemes I and subparallel to the latter, extending from innermost angles of coxae II to juncture with median apodeme. Transverse apodeme apparently absent. Anterior median apodeme strong and conspicuous from its anterior extremity at juncture of apodemes I to point slightly caudad from juncture of apodemes II, becoming less distinct from here to main body suture. Apodemes III slightly longer than apodemes I, extending in anteromedial directions from anterior condyles of coxae III, terminating indistinctly at points the length of genu I behind main body suture. Apodemes IV about twice as long as apodemes III and subparallel to the latter, extending from outer basal angles of coxae IV to points the length of tibia I behind main body suture. Posterior median apodeme extending from point in transverse alignment with anterior extremities of apodemes IV to point just anterior to bases of coxae IV, bifurcating here with each arm continuing to inner basal angle of coxa IV. A conspicuous hysterosomal suture transects body dorsally at anterior two fifths of genital papilla. Dorsal propodosomal plate extended forward to form a broad cephalothoracic hood which covers basal third of capitulum, the truncate anterior margin of hood with dimension slightly exceeding greatest width of capitulum. *Dorsal chaetotaxy*: First pair of dorsal propodosomal setae with length equal to two thirds greatest width of capitulum, situated at anterolateral extremities of cephalothoracic hood and separated from each other by a distance equal to one and one-fourth times length of seta; second dorsal propodosomals two thirds as long as setae of first pair, situated behind first setae a distance equal to length of first seta; third pair of setae one and one-fourth times as long as setae of first pair, situated behind and slightly laterad from second setae a distance equal to one half the distance separating first and second setae; fourth dorsal propodosomals slightly longer than first setae, located behind and slightly laterad from third setae a distance about equal to that separating second and third setae. First pair of dorsal hysterosomal setae as long as first dorsal propodosomals, situated near lateral margins of body two thirds length of seta behind main body suture; second dorsal hysterosomals as long as fourth propodosomals; third pair of setae one and one-half times as long as setae of second pair and situated near lateral margins of genital papilla at anterior fourth of papilla, the setae separated from each other by a distance equal

to one half length of setae; fourth dorsal hysterosomals as long as second dorsal propodosomals, located on lateral margins of genital papilla at about the posterior two fifths of papilla. *Ventral chaetotaxy*: First pair of ventral propodosomal setae slightly shorter than length of genu I, located one half length of seta from median apodeme, this distance behind anterior extremity of apodeme; second ventral propodosomals one and one-half times as long as setae of first pair, located near centers of areas delimited by median apodeme, main body suture and bases of coxae II. First pair of ventral hysterosomal setae as long as second ventral propodosomals, situated the length of seta mesad from anterior extremities of apodemes III, this distance behind main body suture; second ventral hysterosomals one and one-third times as long as setae of first pair, located on apodemes IV at about mid-lengths of apodemes. *Capitulum*: Broadly subcordate, with posterior margin rounded truncate; length, including projecting palpi, 30μ ; greatest width, measured at posterior third, 24μ . Dorsal setae with length equal to width of genu I, situated near anterolateral extremities of capsule; ventral setae two thirds as long as dorsal setae, located near bases of palpi and separated from each other by a distance equal to one and one-third times length of seta. Palpi short and stout, projecting a short distance beyond apex of capsule, indistinctly segmented and ornamented. Chelicerae short and styliform, projecting between and slightly beyond apices of palpi; cheliceral sheaths without transverse striations. *Legs*: Leg I with coxa slightly longer than broad at base, tapering from base to apex, without setae; femur two and one-half times as long as broad at base, with three stout setae and one short bristle; genu broader than long, with three setae; tibia twice as long as broad at base, tapering slightly from base to apex, with one sensory peg nearly as long as basal width of segment, located on outer margin at basal fourth, one short, clavate seta with length equal to one third basal width of segment located ventrally on outer margin at basal fourth, six normal setae; tarsus narrow, elongate, as long as combined lengths of tibia and tarsus II, tapering from base to broadly rounded apex, with one long, broad, blunt seta two thirds as long as segment, situated dorsally near outer margin at base of segment, seven normal setae; tarsus surmounted by a slender pretarsus bearing a conspicuous, subcircular empodium with diameter slightly less than apical width of tarsus, beyond which projects a single, curved claw. Leg II with coxa subquadrangular, slightly longer than broad, without setae; femur twice as long as broad, lateral margins convex,

segment with three setae; genu broader than long, with three setae; tibia slightly longer than broad, outer margins convex, with four setae; tarsus narrow, elongate, more than four times as long as broad at base, slightly longer than combined lengths of genu and tibia, with one broad, blunt, curved seta nearly as long as segment located dorsally near outer margin at base of segment the seta inserted on a short tubercle, four normal setae; tarsus surmounted by a short, narrow pretarsus bearing terminally two strong, curved, spreading claws between which projects a broad empodium. Leg III with coxa two and one-half times as long as greatest breadth, its length almost equal to combined lengths of three apical segments of leg III, without vestiture; basifemur subglobose, as broad as long, without setae; telofemur twice as long as broad, with two setae; genu slightly broader than long, with three setae; tibia nearly twice as long as broad, lateral margins subparallel, with four setae; tarsus narrow, elongate, tapering from base to narrowly rounded apex, with three setae; tarsus surmounted by two curved, spreading claws between and beyond which projects a broad, bilobed empodium. Leg IV with coxa subquadrangular, slightly broader than long, with one ventral seta as long as segment; femur about three times as long as greatest breadth, with one seta one half as long as segment located dorsally near outer margin at apical fourth of segment, one short, stout, pointed, peglike seta located ventrally on inner margin at basal third of segment the seta inserted on a tuberclelike swelling, one strong seta nearly as long as segment located ventrally on inner margin at apical fourth, segment with a spurlike projection on inner margin at apical fourth; tibiotarsus two thirds as long as femur, constricted medially, broad at base, bulbous apex with one long, broad, curved seta longer than segment located dorsally on outer margin at basal fifth of segment, one broad, dorsal, pointed, peglike bristle located near inner margin at apex, one seta two thirds as long as segment located ventrally near inner margin the width of segment before apex, one long, stout seta twice as long as segment situated mid-ventrally just before apex. *Genital papilla*: Subcordate, with anterior margin rounded truncate and having a slight mesal emargination; length, 19 μ ; greatest width, measured at anterior fourth, 20 μ . *Anal plate*: Small and weakly sclerotized, its triradiate apodemal arms each with length equal to basal width of tarsus III, the central disc situated ventrally one half length of genital papilla anterior to anterior margin of the latter. *Measurements*: Length, from tips of palpi to apex of genital papilla, 136 μ ; anterior margin of cephalo-

thoracic hood to apex of genital papilla, 122 μ ; anterior margin of hood to main body suture, 50 μ ; width of body at main body suture, 75 μ ; width at anterior condyles of coxae III, 85 μ .

Female: Body broadly oval, broadest at mid-length; anterior pairs of legs short and stout, legs IV short and robust, their terminal segments not extending to body margins. Anterior apodemes indistinct, those of legs I extending in posteromedial directions from innermost angles of coxae I, converging medially to form a Y-shaped juncture with anterior extremity of median apodeme. Apodemes II extending from innermost angles of coxae II toward mid-point of main body suture, terminating indistinctly at points about two thirds this distance. Transverse apodeme apparently absent. Anterior median apodeme extending from juncture of apodemes I to main body suture, weak and rather indistinct for posterior half of its length. Apodemes III as long as width of coxa III, extending in anteromedial directions from anterior condyles of coxae III, their mesal extremities indistinct. Apodemes IV subparallel to one another for most of their lengths, extending anteriorly from outer basal angles of coxae IV one half the distance to main body suture. Posterior median apodeme indistinct, extending from bases of coxae IV two fifths the distance to main body suture. Dorsum of propodosoma projected anteriorly to form a cephalothoracic hood with a broadly rounded anterior margin, the hood covering basal three fourths of capitulum. Pseudostigmatic organs with expanded, ovate apices slightly longer than the narrow pedicels; areoli with diameters nearly equal to width of expanded apices. Tracheal openings large and conspicuous, situated dorsolaterally at base of cephalothoracic hood. *Dorsal chaetotaxy:* First pair of dorsal propodosomal setae with length equal to about one half the distance between tracheal openings, situated just anterior and medial to caudolateral extremities of cephalothoracic hood; second pair of dorsal propodosomal setae about twice as long as first pair, located just above and slightly behind areoli of pseudostigmatic organs. First pair of dorsal hysterosomal setae with length equal to length of tibiotarsus I, located on lateral margins of body one fourth length of seta behind main body suture; second pair of setae two thirds as long as first pair, located one and one-half times length of seta from lateral margins of body at points in line with anterior thirds of coxae III; third pair of setae with length subequal to second pair, situated one and one-half times length of seta from lateral margins of body, slightly behind and laterad to trochanters IV; fourth pair

of dorsal hysterosomal setae with length equal to width of femur III, located on lateral margins of body at mid-opisthosoma; fifth pair of setae twice as long as fourth pair, located one third length of seta from hind margin of penultimate segment, separated from each other at their bases by a distance equal to three fourths length of seta, when extending directly caudad their tips projecting slightly beyond apex of body; sixth pair of dorsal hysterosomal setae having length subequal to fifth pair, situated near lateral margins of body at basal third of apical segment. *Ventral chaetotaxy*: First pair of ventral propodosomal setae with length equal to basal width of tibiotarsus I, located slightly more than length of seta laterad from Y-shaped juncture of apodemes I and anterior median apodeme; second pair slightly longer than first pair, situated slightly behind apodemes II at their mid-lengths. First pair of ventral hysterosomal setae with length equal to width of coxa III, located one fourth length of seta behind main body suture and separated from each other by a distance equal to twice length of seta; second pair of ventral hysterosomal setae as long as first pair, located between inner margins of coxae III and apodemes IV, in line with mid-lengths of coxae III; third ventral hysterosomals minute, located at apex of opisthosoma. *Capitulum*: Length, 32μ ; width, 35μ ; subcordate with posterior margin rounded truncate, anterior margin broadly rounded with palpi and chelicerae projecting slightly. Dorsal setae with length equal to one fourth greatest breadth of capitulum, inserted on lateral margins of capsule in line with bases of palpi. Ventral setae two thirds as long as dorsal setae, separated from each other by a distance equal to one and one-half times length of seta. Palpi indistinctly ornamented and segmented. Chelicerae normal; cheliceral sheaths without striae. *Legs*: Leg I with coxa subquadrangular, as broad as long, without setae; femur nearly as broad at base as long, basal half of segment bulbous, lateral margins strongly convex, segment with three setae; genu as broad at base as long, lateral margins converging abruptly at apical third of segment, with four normal setae; tibiotarsus robust, about four times as long as broad at base, tapering very little from base to apex, vestiture dense, consisting of one lanceolate seta slightly longer than basal width of segment located dorsally on outer margin at basal third, one ventral, lanceolate seta with length equal to one half basal width of segment located on outer margin the length of seta from base of segment, one short, pointed bristle having length equal to two thirds basal width of segment, located ventrally near

outer margin the length of seta from base, eleven normal setae; blunt apex of tibiotarsus surmounted immediately by a strong, curved claw and a small empodium. Leg II similar in size and general shape to leg I, with coxa subquadrangular, nearly one and one-half times as broad as long, without setae; femur about one and one-half times as long as broad at base, proximal two thirds of segment greatly expanded, bulbous, segment with three setae; genu about as broad as long, inner margin abruptly convergent at apical fourth of segment, with four setae; tibia one and one-half times as long as broad, slightly broader at apex than at base, with one peglike seta having length equal to basal width of segment, located dorsally near outer margin at base, with one broad, stout, lanceolate spine four times as long as broad at base, its length equal to basal width of segment, situated ventrolaterally on wartlike expansion of outer margin at apex of segment, two normal setae; tarsus slightly longer than broad at base, tapering to narrowly rounded apex, segment with a single seta one and one-half times length of tarsus located middorsally near outer margin; tarsus subtends a pair of strong, spreading, curved claws and a reduced empodium, the terminal appendages borne on a short pretarsal segment. Leg III rather short and robust; coxa broad, oval, about twice as long as greatest breadth, inner and outer margins convex, segment without vestiture; femur about three times as long as broad, expanding slightly from basal third to apex, with four setae; tibia one and one-half times as long as broad at base, tapering slightly to apex, with three setae; tarsus narrow, elongate, about five times as long as broad at base, tapering slightly to bluntly rounded apex, with four normal setae; tarsus surmounted by a narrow pretarsus, as long as basal width of tarsus and bearing apically a pair of large, spreading, curved claws between which projects a broad empodium. Leg IV with coxa small, subquadrangular, nearly one and one-half times as broad as long, its inner margin separated from this margin of opposite coxa by a distance slightly less than width of coxa, segment without seta; trochanter collarlike, twice as broad as long, without vestiture; third segment slightly more than four times as long as broad at base, lateral margins subparallel, with one ventrolateral seta having length equal to twice width of segment, situated near outer margin one third length of seta from base of segment, one ventrolateral seta two thirds as long as segment, located near inner margin one third length of seta from apex of segment; fourth segment one third as long as third segment, about twice as long as broad at base, with one stout, ventral seta as long as combined

lengths of third and fourth segments of leg IV, situated one half width of segment before apex, one terminal seta on segment, slightly longer than subterminal seta but not as broad as the latter basally. *Measurements:* Length from tip of cephalothoracic hood to apex of opisthosoma, 173 μ ; anterior margin of cephalothoracic hood to main body suture, 75 μ ; width of body at main body suture, 105 μ .

Types: Belle, Maryland, Oct. 16, 1933, F. F. Smith, on *Fragaria* sp.

Location of types: United States National Museum, slide number 1129.

The writer had two specimens of this species available for study. These were of each sex and contained the following data: Belle, Maryland, Oct. 16, 1933, strawberry, F. F. Smith. These specimens undoubtedly represent some of the type material from which Ewing derived his original description although the slides were not identified by the type number. The cotype series, including males and females, remounted one mite per slide from the single original slide, make it possible at this time to designate as lectotype one of the male specimens which is identified by U.S.N.M. No. 1129-A.

These mites are an apple green in color and the male is quite distinctive, being readily distinguished from other tarsonemid species by characters mentioned in the preceding keys. The female, on the other hand, lacks an obvious character for differentiation from other species of tarsonemids and hence details of tibiotarsus I chaetotaxy must be relied upon for identification.

ADDENDUM

Due to the fact that to date keys to the females of mites in the family Tarsonemidae, where they exist, are not readily usable for reasons mentioned in an earlier section of this paper (External Morphology and Terminology), there follows below such a key to the species included in the present paper.

KEY TO FEMALES OF WESTERN HEMISPHERE TARSONEMIDAE

1. Palpi greatly elongated, projecting forward to form a snoutlike beak *R. niger*, p. 1221
- Palpi not greatly elongate, never forming a conspicuous beak 2
2. Integument with conspicuous reticulations *T. truncatus*, p. 1220
- Integument without conspicuous reticulations 3
3. Hysterosoma with an extra pair of ventral setae situated between coxae IV *H. latus*, p. 1293
- Hysterosoma without a pair of ventral setae situated between coxae IV 4

4. Femur I with a stout lanceolate seta and two or three normal setae 5
Femur I without a stout seta 6
5. First ventral propodosomal seta located on or in front of apodeme I *T. randsi*, p. 1133
First ventral propodosomal seta located well behind apodeme I *S. pallidus*, p. 1267
6. Pseudostigmatic organs never with apices expanded, organs spine-like *T. dispar*, p. 1148
Pseudostigmatic organs with expanded apices subtended by slender pedicels 7
7. Pseudostigmatic organs with expanded apices acuminate distally, 8
Pseudostigmatic organs not acuminate distally 9
8. First pair of ventral propodosomal setae situated on or in front of apodemes I; hosts are bamboos and related plants,
S. phyllophorus, p. 1244
First pair of ventral propodosomal setae situated well behind apodemes I; hosts are liliaceous and related plants *S. laticeps*, p. 1231
9. Terminal seta of leg IV short, only slightly longer than subterminal seta of fourth segment 10
Terminal seta of leg IV elongate, always much longer than subterminal seta of fourth segment 11
10. Pseudostigmatic organs with expanded apices elongate oval; femur I with normal setae only *X. viridis*, p. 1314
Pseudostigmatic organs with expanded apices subcircular; femur I with a stout, lanceolate seta and two normal setae,
H. tepidariorum, p. 1308
11. First ventral propodosomal seta situated well behind apodeme I 12
First ventral propodosomal seta situated on or nearly on apodeme I 15
12. Genu II with a stout lanceolate or spinelike seta and two normal setae 13
Genu II with normal setae only 14
13. Second ventral hysterosomal setae situated on apodemes II; body slender, elongate, with anterior pairs of legs widely separated from posterior pairs; plant host, pineapple *S. ananas*, p. 1276
Second ventral hysterosomals located well behind apodemes II; body broadly oval *T. sulcatus*, p. 1155
14. Pseudostigmatic organs with expanded apices elongate oval; genu I with three setae *T. texanus*, p. 1196
Pseudostigmatic organs with expanded apices broadly oval; genu I with four setae *S. chionaspivorus*, p. 1285
15. Body elongate with anterior pairs of legs widely separated from posterior pairs; tracheal atria often prominent, elongate and bilobed 16
Body broadly oval; tracheal atria never bilobed 19
16. First ventral propodosomal setae situated in front of apodemes I *S. spirifex*, p. 1261
First ventral propodosomals located on or behind apodemes I 17
17. Small species, less than 150 μ , from anterior margin of cephalothoracic hood to apex of opisthosoma *S. latipes*, p. 1238

- Large species, measuring more than 200 μ , from anterior margin of hood to apex of opisthosoma. 18
18. Second ventral propodosomal setae situated well behind apodemes II; pseudostigmatic organs with expanded apices elongate oval; genu II with one lanceolate seta, one peglike seta and one normal seta *S. bancrofti*, p. 1249
- Second ventral propodosomals situated nearly on apodemes II; pseudostigmatic organs with apices broadly oval; genu II with one stout, lanceolate seta and two normal setae *S. hyaleos*, p. 1256
19. Expanded apical portions of pseudostigmatic organs subcircular 20
- Expanded apical portions of pseudostigmatic organs oval 23
20. Anterior margin of cephalothoracic hood sharply rounded, nearly acuminate mesally *H. peregrinus*, p. 1300
- Anterior margin of cephalothoracic hood truncate 21
21. First ventral propodosomal setae situated well behind apodemes I, ... *T. cryptocephalus*, p. 1162
- First ventral propodosomal setae situated on or very nearly on apodemes I 22
22. Femur II with one stout, lanceolate seta and one or two normal setae; propodosoma with a conspicuous dorsal apodeme, ... *T. setifer*, p. 1125
- Femur II with normal setae only; propodosoma without a dorsal apodeme *S. fulgens*, p. 1281
23. First ventral propodosomal setae located well behind apodemes I, 24
- First ventral propodosomal setae located on or very nearly on apodemes I 25
24. Transverse apodeme with two conspicuous notches mesally, ... *T. confusus*, p. 1173
- Transverse apodeme, if present, without two mesal notches, ... *T. smithi*, p. 1141
25. Genu II with normal setae only; transverse apodeme, if present, strong for its entire length 27
- Genu II with one modified seta, either lanceolate or stout and spinelike; transverse apodeme strong for most of its length but weak or absent for a short distance mesally 29
26. Transverse apodeme apparently absent; tibiotarsus I with largest annulated, sensory seta located distinctly basad from mid-segment 28
- Transverse apodeme strong and conspicuous for its entire length; tibiotarsus I with largest annulated, sensory seta situated at mid-segment *T. waitei*, p. 1181
27. Tibiotarsus I robust, two and one-half times as long as broad; leg I claw of moderate size *T. simplex*, p. 1188
- Tibiotarsus I more than three times as long as broad at base; claw of leg I very small *T. pritchardi*, p. 1202
28. Tibiotarsus I with three specialized sensory setae near base of segment *T. scaurus*, p. 1213
- Tibiotarsus I with a single specialized sensory seta near base of segment *T. occidentalis*, p. 1117

LIST OF SYNONYMS AND OTHER NAMES ENCOUNTERED IN THE
LITERATURE OF THE FAMILY TARSONEMIDAE *

Acarus Linnaeus, 1856:

translucens Nietner, 1861. (Probably Canestriniidae.)

translucens Green (not Nietner, 1861), 1890 = *Hemitarsonemus latus* Banks.
woodi Rennie, 1918 = *Acarapis woodi* (Rennie). (Tarsopolipodidae.)

Avrosia Oudemans, 1928. (? Canestriniidae; believed by some workers to be a senior synonym of *Hemitarsonemus* Ewing.)

Cheylurus socialis Trouessart, 1885 = *Tarsonemus floricolus* Canestrini and Fanzago.

Dendroptus robinii Kramer, 1876 = *Tarsonemus floricolus* C. and F. according to Oudemans (1926).

Hemitarsonemus Ewing, 1939:

latus (Banks), 1904.

peregrinus, new species in this paper.

tepidariorum Warburton, 1904.

Microdispodides Vitzthum, 1914. (Scutacaridae.)

Pseudotarsonemoides Vitzthum, 1921. (Tarsopolipodidae.)

cryptocephalus Ewing, 1939 = *Tarsonemus cryptocephalus* (Ewing). New synonymy in this paper.

Stencotarsonemus, new genus in this paper.

ananas (Tryon), 1908.

bancrofti (Michael), 1890.

chionaspivorus (Ewing), 1911.

fulgens, new species in this paper.

hyaleos, new species in this paper.

laticeps (Halbert), 1923.

latipes (Ewing), 1939.

pallidus (Banks), 1901.

phyllophorus (Ewing), 1924.

spirifex (Marchal), 1902.

Tarsolarkus Thor, 1904. (? Pyemotidae.)

Tarsonemella Hirst, 1923. (? Tarsopolipodidae.)

Tarsonemoides Trägårdh, 1904. (? Scutacaridae.)

Tarsonemus Canestrini and Fanzago, 1876:

africanus Hirst, 1923. (Probably Tarsopolipodidae.)

apis Rennie, 1918. (Probably Tarsopolipodidae.)

ananas Tryon, 1908 = *Stencotarsonemus ananas* (Tryon). New combination in this paper.

approximatus Banks, 1914 = *Stencotarsonemus chionaspivorus* (Ewing). New combination in this paper.

approximatus var. *narcissi* Ewing, 1929 = *Stencotarsonemus laticeps* (Halbert).

assimilis Banks, 1914 = *confusus* Ewing.

aurantii Oudemans, 1927.

bakeri Ewing, 1939 = *setifer* Ewing.

bancrofti Michael, 1890 = *Stencotarsonemus bancrofti* (Michael). New combination in this paper.

* This is a list of names applied to mite species belonging to the family Tarsonemidae or confused with mites of this family.

- biungulatus* Ewing, 1939 = *smithi* Ewing.
brevipes Sicher and Leonardi, 1895.
buxi Canestrini and Berlese, 1884.
canestrinii Marchal.
chionaspivorus Ewing, 1911 = *Steneotarsonemus chionaspivorus* (Ewing).
 New combination in this paper.
chironiae Warburton, 1904.
confusus Ewing, 1939.
contubernalis Reuter, 1906.
culmicolus Reuter, 1900.
destructor Reuter, 1905. Synonym of *Steneotarsonemus pallidus* (Banks) according to Ewing (1939).
dispar, new species in this paper.
equipes Sicher and Leonardi, 1895.
femoralis Ewing, 1939 = *smithi* Ewing. New synonymy in this paper.
fennicum Oudemans, 1915.
floricolus Canestrini and Fanzago, 1876. Synonym of *T. minusculus* according to Oudemans (1926).
fragariae Zimmerman, 1905 = *Steneotarsonemus pallidus* (Banks).
fusarii Cooreman, 1941.
hominis Dahl, 1910.
hydrocephalus Vitzthum, 1939 = *Steneotarsonemus laticeps* (Halbert).
intectus Karpelles, 1886.
interruptus Vitzthum, 1928.
iowensis Ewing, 1939 = *randsi* Ewing. New synonymy in this paper.
kirchneri (Kramer), 1876.
krameri ?
laminifer Ewing, 1939.
laticeps Halbert, 1923 = *Steneotarsonemus laticeps* (Halbert). New combination in this paper.
latipes Ewing, 1939 = *Steneotarsonemus latipes* (Ewing). New combination in this paper.
latus Banks, 1904 = *Hemitarsonemus latus* (Banks).
macronychus Sicher and Leonardi, 1895. Synonym of *T. floricolus* C. and F. according to Berlese (1894).
minimax Vitzthum, 1926.
minusculus Canestrini and Fanzago, 1876.
moliniensis Cooreman, 1947.
occidentalis Ewing, 1939.
oryzae Targioni-Tozzetta, 1878.
ovivorus Oudemans, 1927.
pallidus Banks, 1899 = *Steneotarsonemus pallidus* (Banks). New combination in this paper.
pellucens Green, ?
phyragmitidis v. Schlechtendahl, 1896.
phyllophorus Ewing, 1924 = *Steneotarsonemus phyllophorus* (Ewing). New combination in this paper.
pseudosetifer Ewing, 1939. *Nomen dubium*.
randsi Ewing, 1939.
robinii (Kramer), 1876 = *T. floricolus* C. and F.

- sauli* Dahl, 1910.
scaurus Ewing, 1939.
setifer Ewing, 1939.
simplex Ewing, 1939.
smithi Ewing, 1939.
socialis (Trouessart), 1885 = *T. floricolus* C. and F. according to Berlese (1894).
soricicola Oudemans, 1903.
spinipes Hirst, 1912 = *Steneotarsonemus bancrofti* (Michael).
spirifex Marchal, 1902 = *Steneotarsonemus spirifex* (Marchal). New combination in this paper.
supinoi Sieher and Leonardi, 1895 = *T. floricolus* C. and F. according to Berlese (1894).
tepidariorum Warburton, 1904 = *Hemitarsonemus tepidariorum* (Warburton).
texanus Ewing, 1939.
translucens (Green), (not Nietner, 1861) 1890 = *Hemitarsonemus latus* (Banks).
truncatus Ewing, 1939.
typhae Oudemans, 1929.
ulci ?
uncinatus Flemming, 1884.
unguis Ewing, 1939.
viridis Ewing, 1939 = *Xenotarsonemus viridis* (Ewing). New combination in this paper.
waitei Banks, 1912.
woodi (Rennie), 1918. (Tarsopolipodidae.)
Rhynchotarsonemus, new genus in this paper.
niger, new species in this paper.
Therismoptes Amerling, 1861. *Nomen dubium*.
Xenotarsonemus, new genus in this paper.
viridis (Ewing), 1939.

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EXPLANATION OF PLATES*

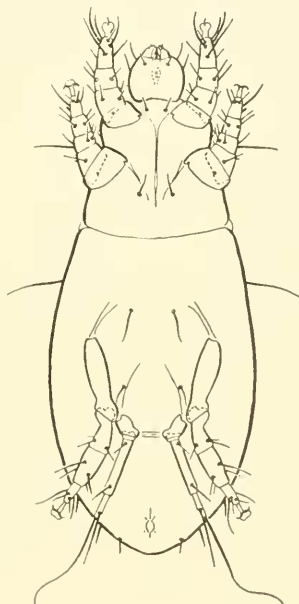
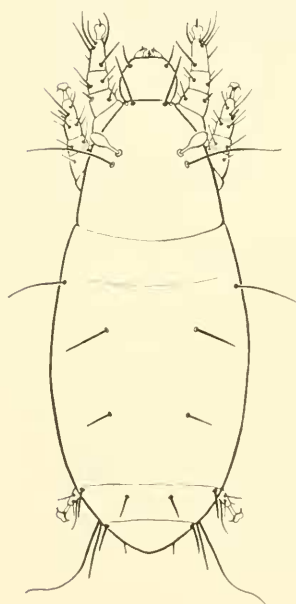
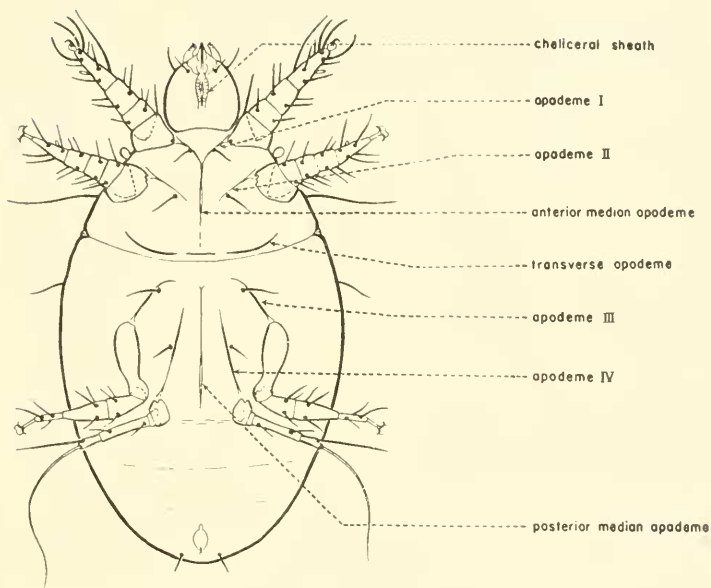
PLATE 1

Ventral aspect of a typical (hypothetical) female mite of the genus *Tarsonemus* identifying certain morphological structures with terminology used in the text.

Dorsal and ventral aspects of female *Steneotarsonemus hyaleos*, n. sp.; drawn from allotype.

* All drawings of whole mites are made to the same scale of magnification. Tibiotarsal segments of females are presented in identical enlargement as are also the male hind legs and the pseudostigmatic organs figured.

PLATE 1



S. hyaleas

PLATE 2

Types of pseudostigmatic organs found in the family Tarsonemidae (same scale of magnification for all species figured).

Dorsal aspects of propodosomal areas of *Tarsonemus waiti* and *Stenotarsonemus phyllophorus* showing position of tracheal atria in relation to dorsal chaetotaxy (same degree of magnification).

Types of transverse apodemes found in females of five species of *Tarsonemus* (diagrammatic).

Lateral aspect of portion of male hysterosoma in the species *Hemitarsonemus latus*, showing natural position of genital papilla, anal plate, etc.

PLATE 2



S. fulgens



T. cryptocephalus



T. smithi



R. niger



X. viridis



H. peregrinus



S. phyllaphorus



T. pritchardi



S. laticeps

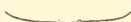


H. latus

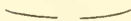


T. dispar

TYPES OF
PSEUDOSTIGMATIC ORGANS



T. confusus



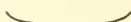
T. scaurus



T. randsi



T. smithi



T. setifer



T. simplex



T. waitei



S. phyllaphorus

TYPES OF
TRANSVERSE APODEMES
♀♀

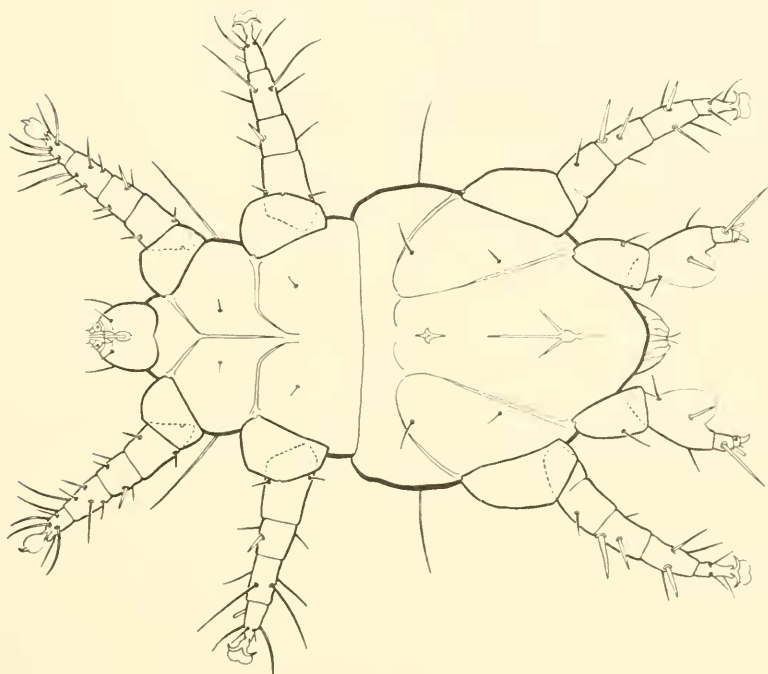
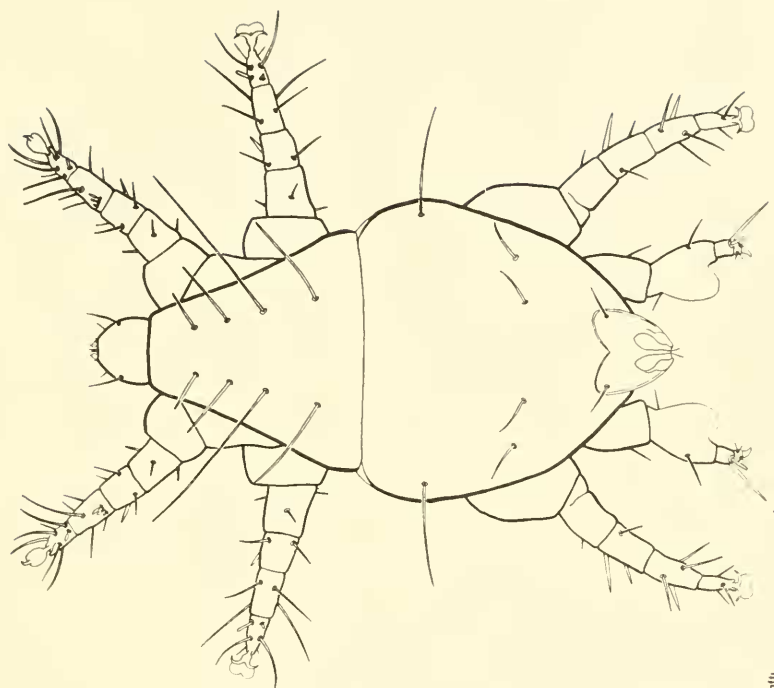


H. latus ♂

PLATE 3

Stencotarsonemus bancrofti male in dorsal and ventral aspect.

PLATE 3

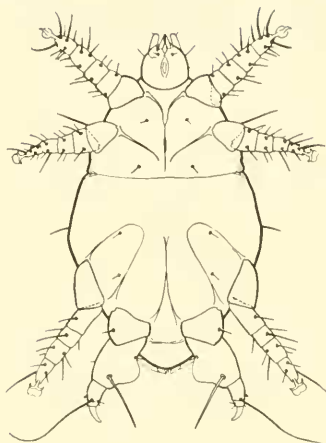
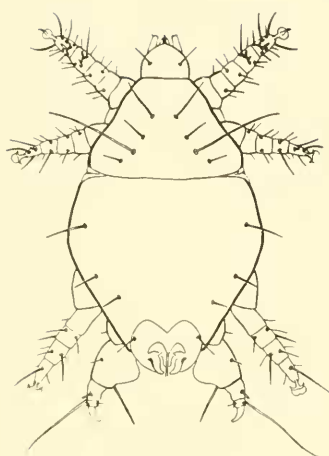


S. bencafti

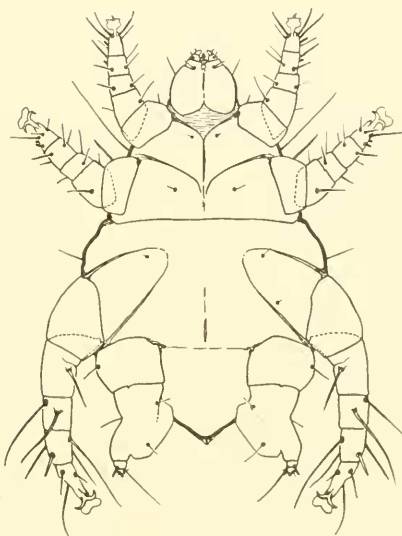
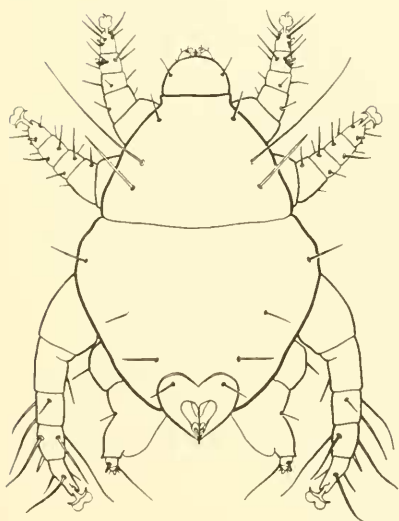
PLATE 4

S. pallidus and *S. phyllophorus* males in dorsal and ventral aspects.

PLATE 4



S. pallidus

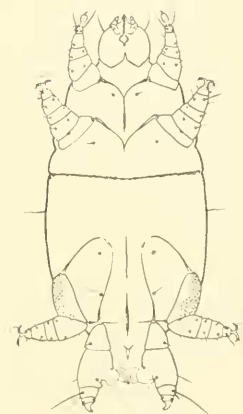
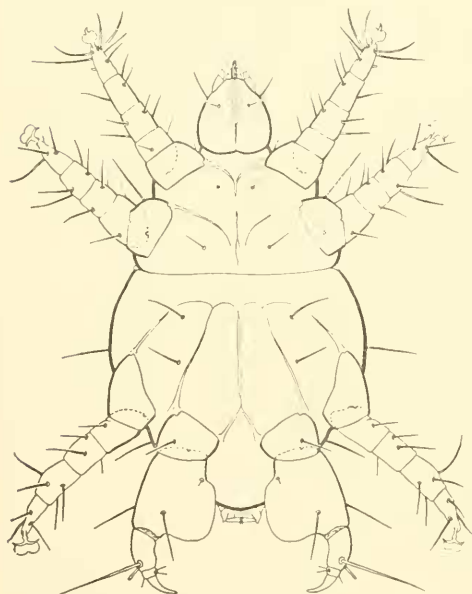
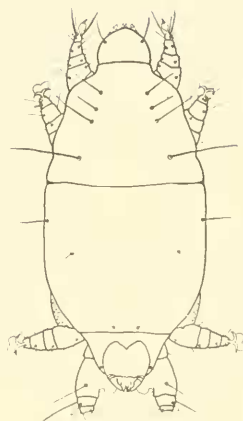
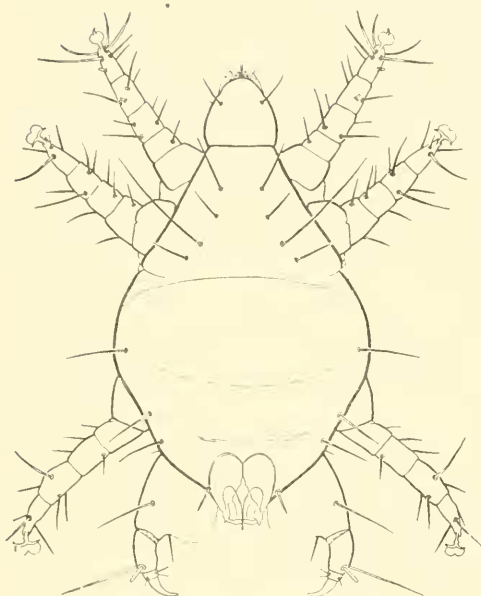


S. phyllophorus

PLATE 5

S. fulgens and *S. hyaleos* males in dorsal and ventral aspects; both drawn from holotype specimens.

PLATE 5



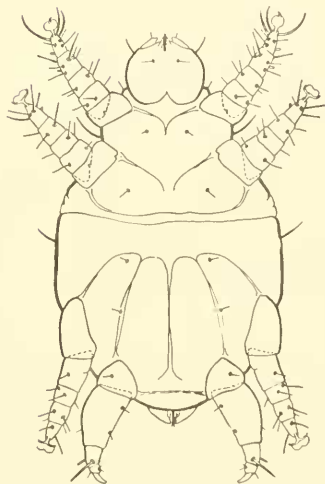
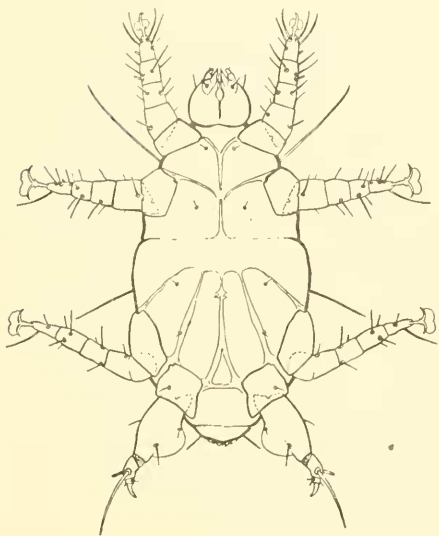
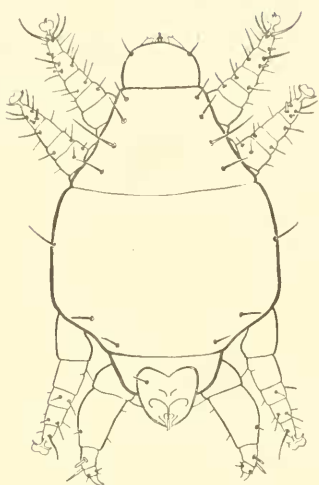
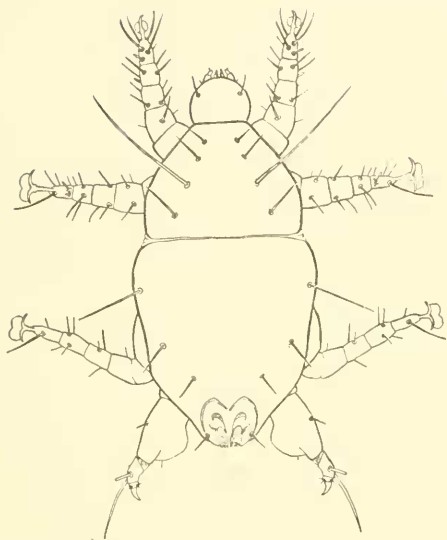
S. hyaleus

S. fulgens

PLATE 6

S. ananas and *S. laticeps* males in dorsal and ventral aspects.

PLATE 6



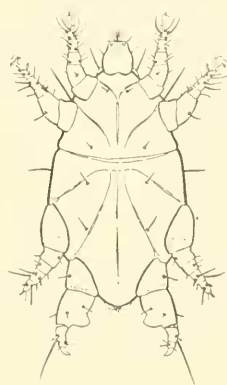
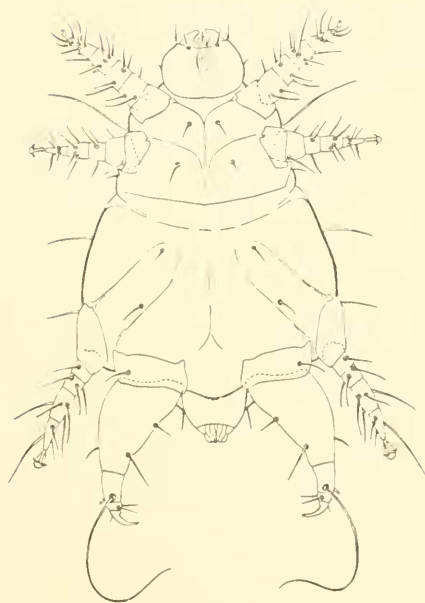
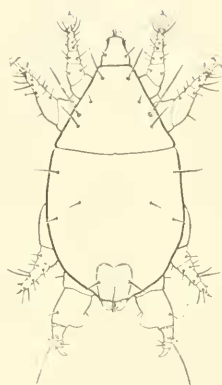
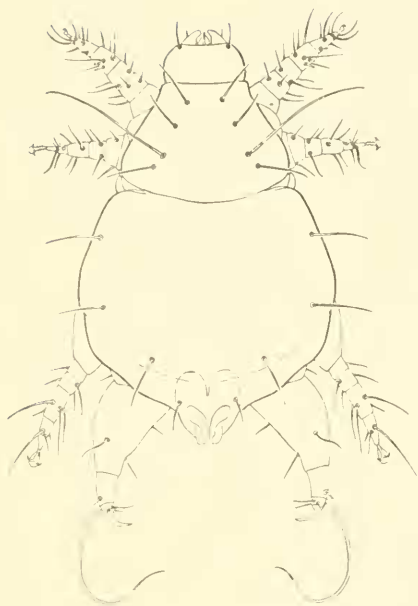
S. anandae

S. lahceps

PLATE 7

S. chionaspivorus and *S. latipes* males in dorsal and ventral aspects; the latter drawn from cotype.

PLATE 7



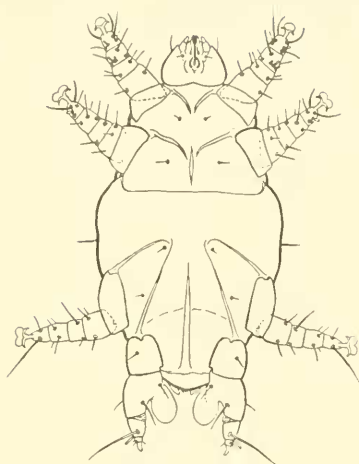
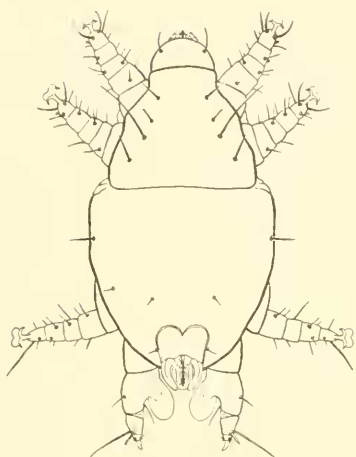
S. latipes

S. chionospivorus

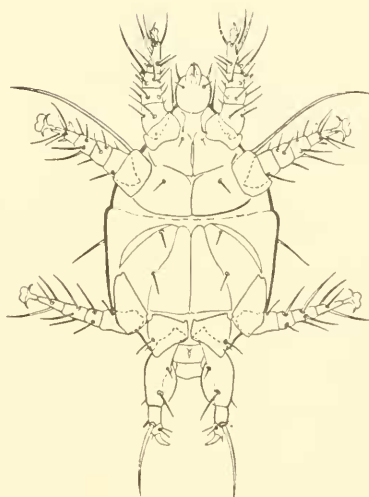
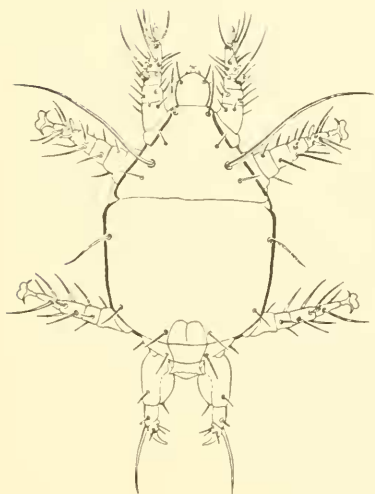
PLATE 8

S. spirifex and *Tarsonemus dispar* males in dorsal and ventral aspects; the latter drawn from holotype.

PLATE 8



S. spirifex

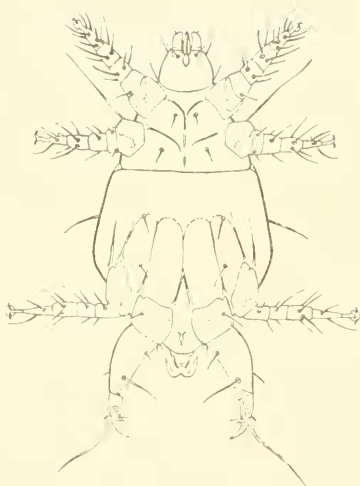
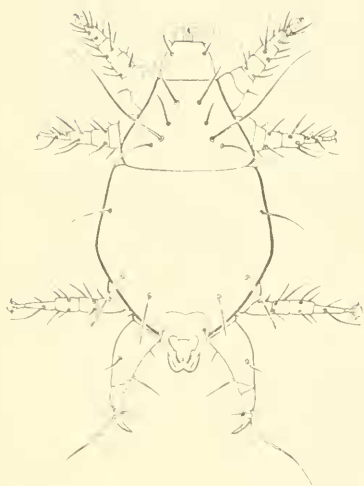


T. dispar

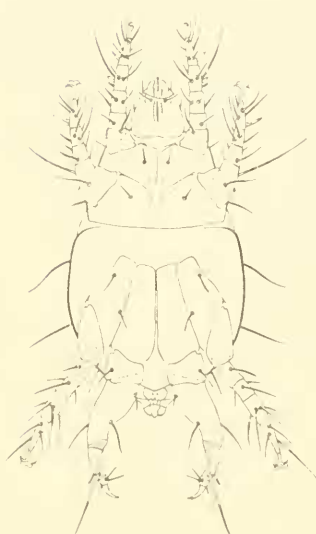
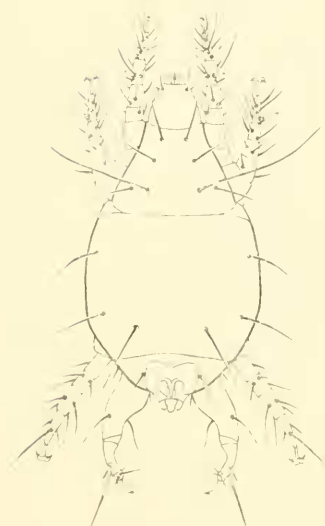
PLATE 9

T. setifer and *T. smithi* males in dorsal and ventral aspects.

PLATE 9



T. seifer

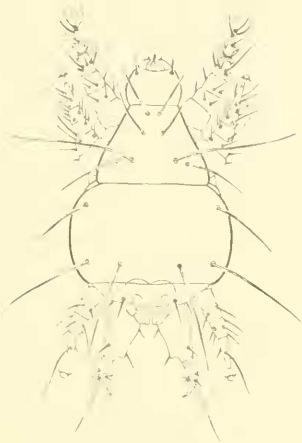


T. smithi

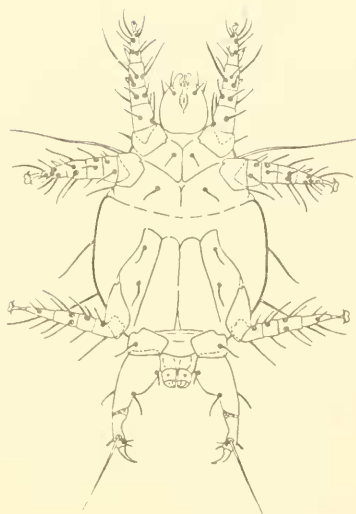
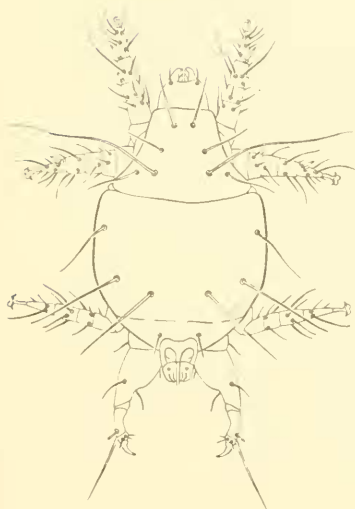
PLATE 10

T. laminifer and *T. sulcatus* males in dorsal and ventral aspects; the latter drawn from holotype.

PLATE 10



T. lominifer

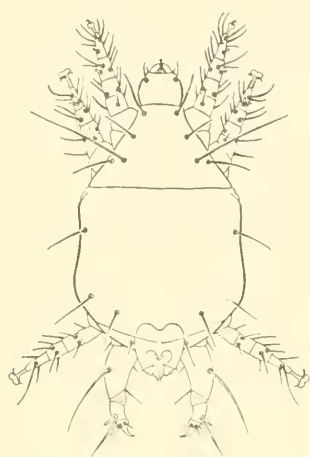


T. sulcatus

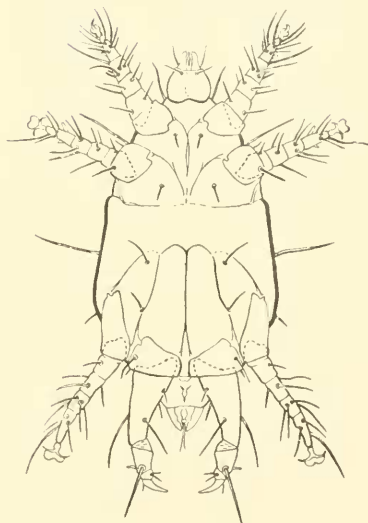
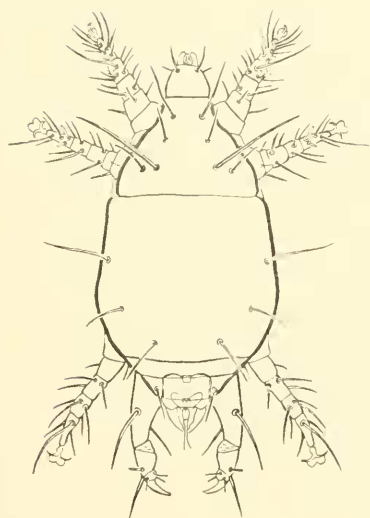
PLATE 11

T. occidentalis and *T. randsi* males in dorsal and ventral aspects; the latter drawn from cotype.

PLATE 11



T. occidentalis

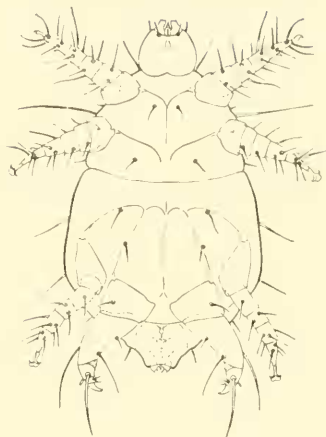
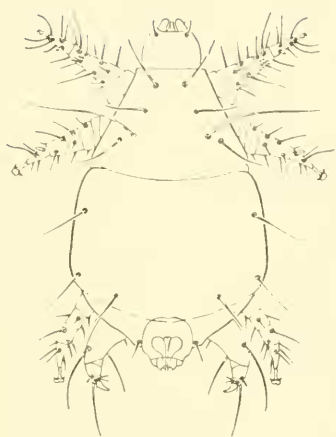


T. randsi

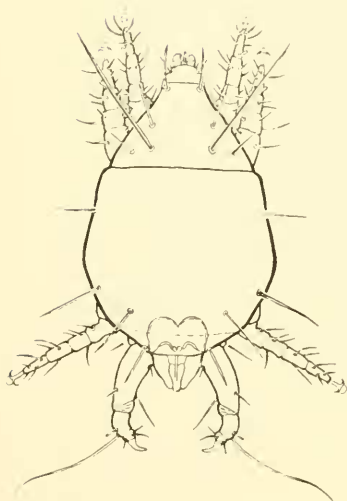
PLATE 12

T. unguis and *T. cryptocephalus* males in dorsal and ventral aspects; the former drawn from type specimen, the latter from cotype.

PLATE 12



T. unguis

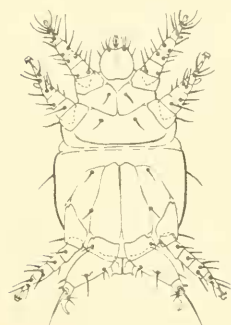
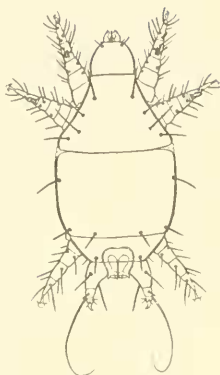
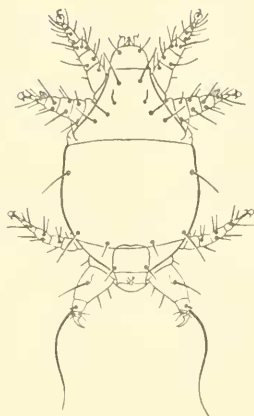
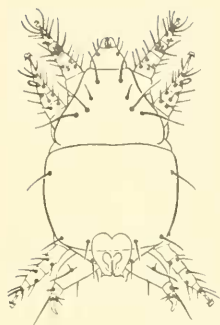


T. cryptocephalus

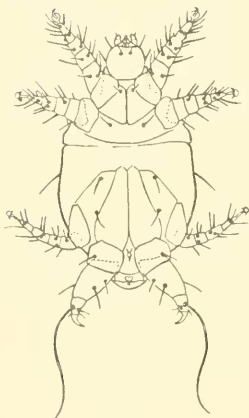
PLATE 13

T. waitei, *T. simplex*, *T. confusus* and *T. pritchardi* males in dorsal and ventral aspects; the latter drawn from holotype.

PLATE 13



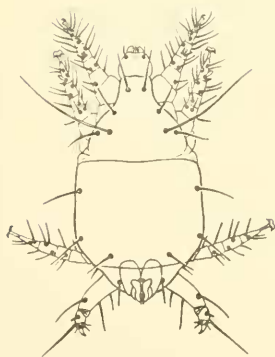
T. waiti



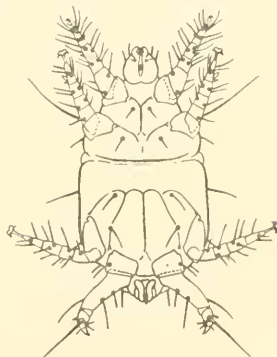
T. simplex



C. pritchardi



T. confusus



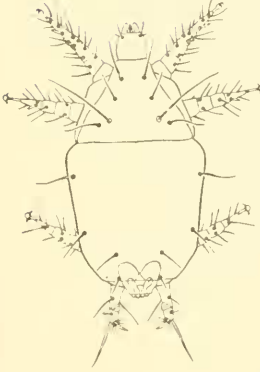
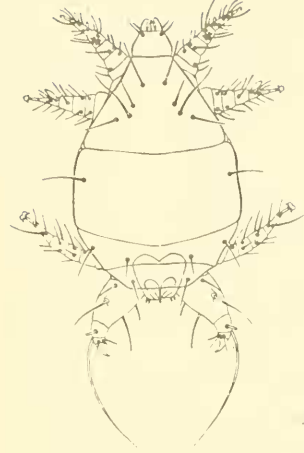
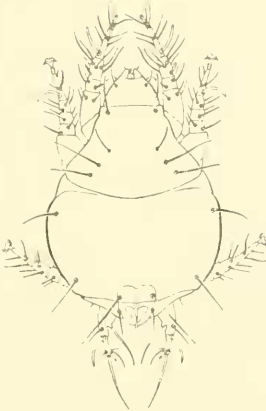
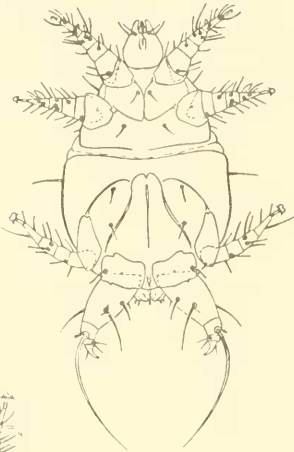
T. confusus

PLATE 14

T. texanus, *T. scaurus* and *Xenotarsonemus viridis* males in dorsal and ventral aspects.

PLATE 14

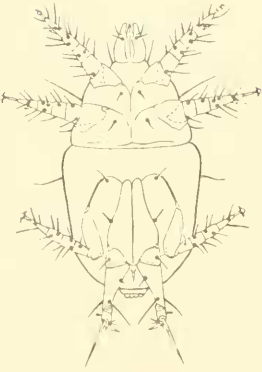
T. texanus



T. scourus



T. scourus



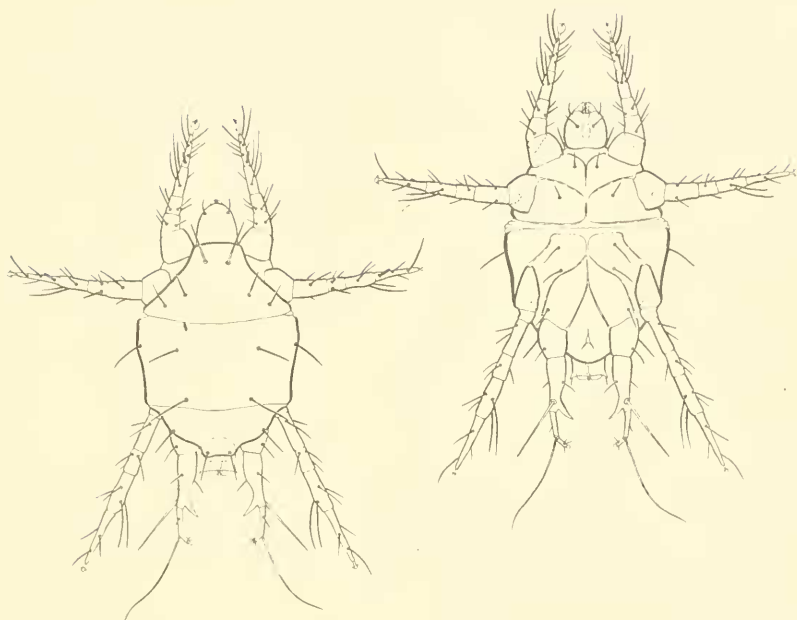
X. viridis



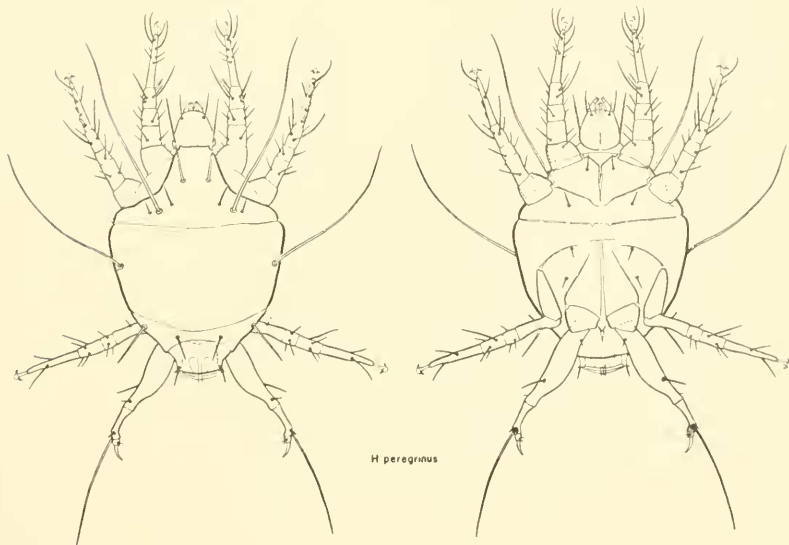
PLATE 15

Hemitarsonemus latus and *H. peregrinus* males in dorsal and ventral aspects; the latter drawn from holotype.

PLATE 15



H. lotus

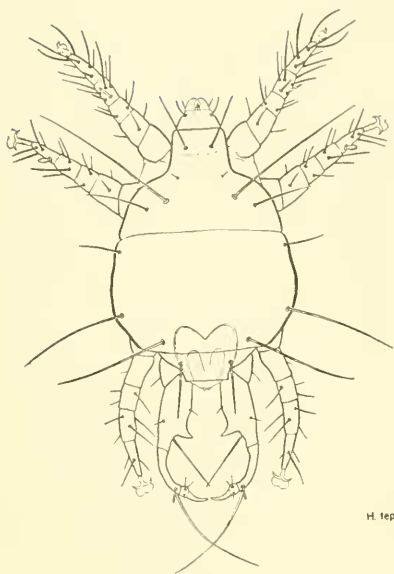


H. peregrinus

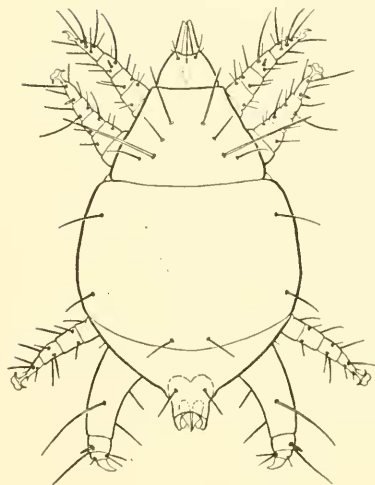
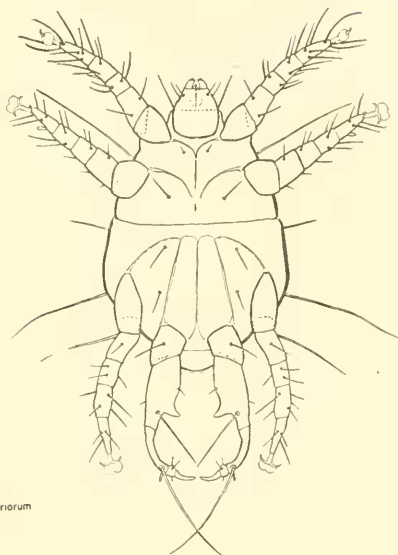
PLATE 16

H. tepidariorum and *Rhynchotarsonemus niger* males in dorsal and ventral aspects; the latter drawn from paratype.

PLATE 16



H. tepidariorum



R. niger

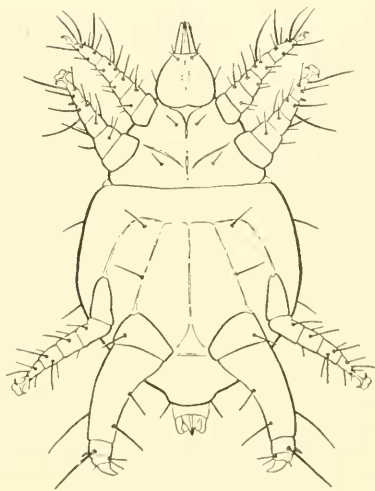


PLATE 17

Hind legs of males in the genus *Stencotarsonemus*:

S. hyuleos, n. sp. (drawn from holotype).

S. ananas.

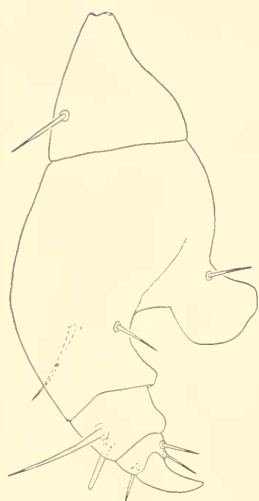
S. spirifex.

S. bancrofti.

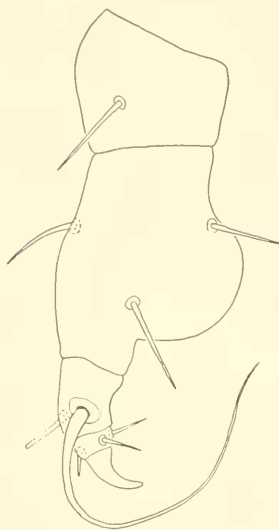
S. phyllophorus.

S. pallidus.

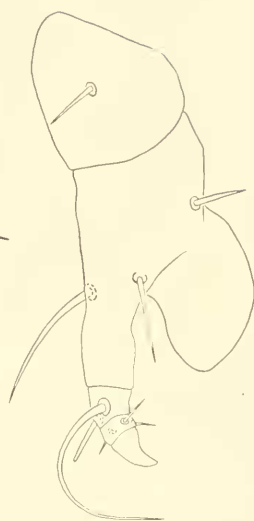
PLATE 17



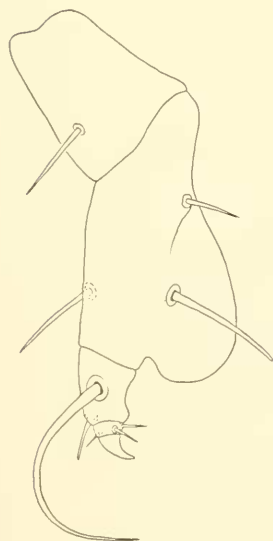
S. hyaleos



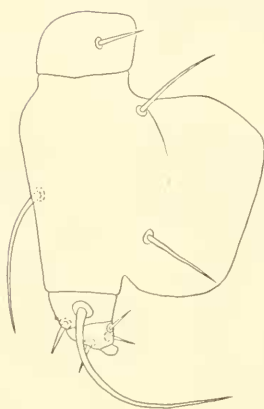
S. ananos



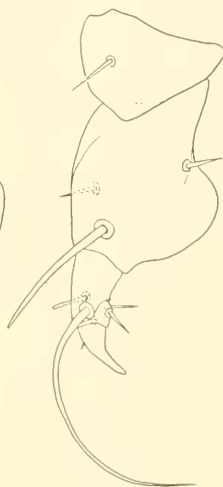
S. spirifex



S. bancrofti



S. phyllophorus



S. pallidus

PLATE 18

Hind legs of males:

Steneotarsonemus fulgens, n. sp. (drawn from holotype).

S. laticeps.

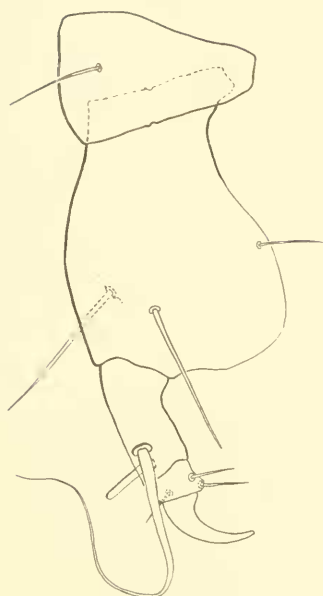
S. latipes (drawn from cotype).

Tarsonemus occidentalis.

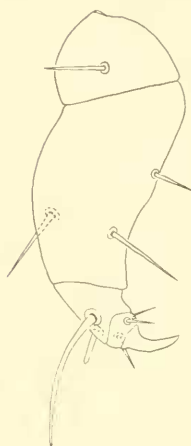
T. setifer.

T. randsi (drawn from cotype).

PLATE 18



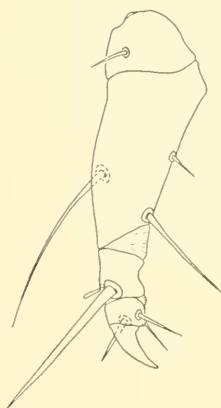
S. fulgens



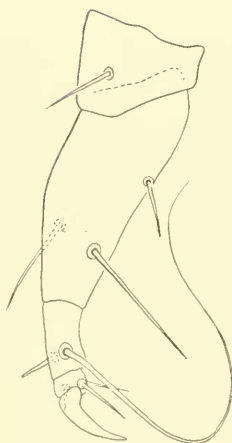
S. laticeps



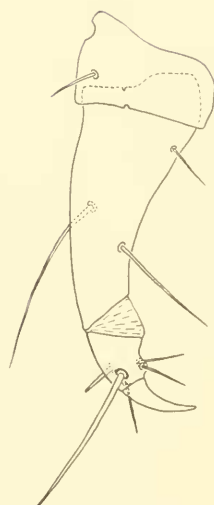
S. latipes



T. occidentalis



T. setifer



T. randsi

PLATE 19

Hind legs of males:

T. smithi.

T. dispar, n. sp. (drawn from holotype).

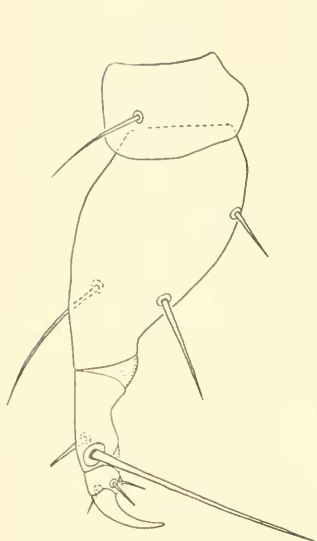
T. sulcatus, n. sp. (drawn from holotype).

T. cryptocephalus (drawn from cotype).

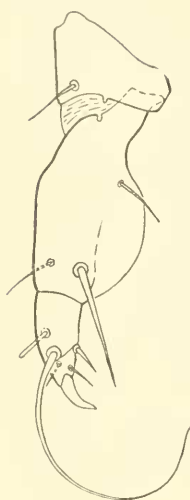
T. laminifer (drawn from cotype).

Steneotarsonemus chionaspivorus.

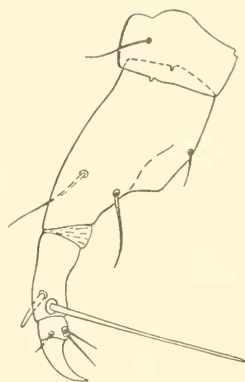
PLATE 19



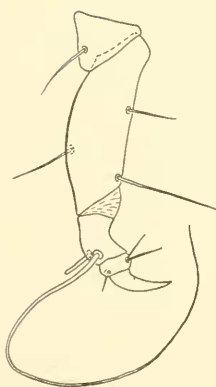
T. smithi



T. dispar



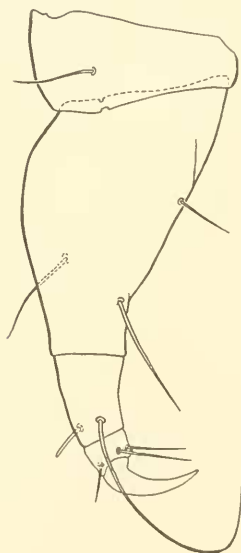
T. sulcatus



T. cryptocephalus



T. laminifer



S. chionaspivorus

PLATE 20

Hind legs of males in the genus *Tarsonemus*:

T. confusus.

T. waitei.

T. simplex.

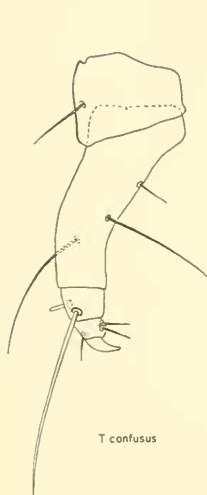
T. pritchardi, n. sp. (drawn from holotype).

T. texanus (drawn from cotype).

T. scaurus (drawn from cotype).

T. unguis (drawn from type).

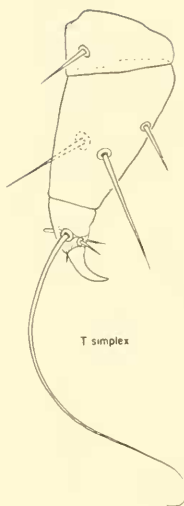
PLATE 20



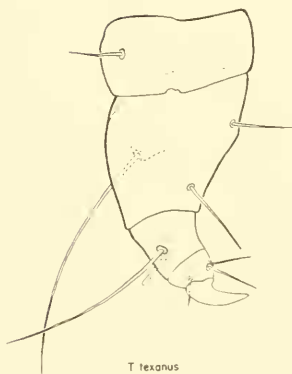
T. confusus



T. waitei



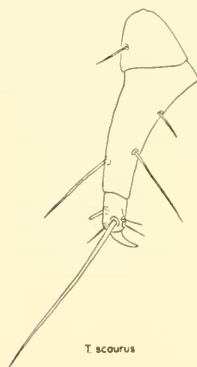
T. simplex



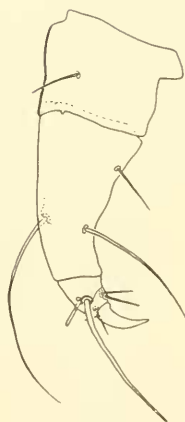
T. texanus



T. pritchardi



T. scourus



T. unguis

PLATE 21

Hind legs of males:

Xenotarsonemus viridis.

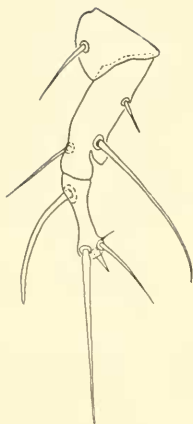
Rhynchotarsonemus niger, n. sp. (drawn from paratype).

Hemitarsonemus tepidariorum.

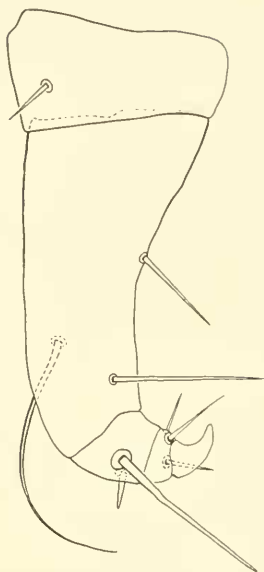
H. peregrinus, n. sp. (drawn from paratype).

H. latus.

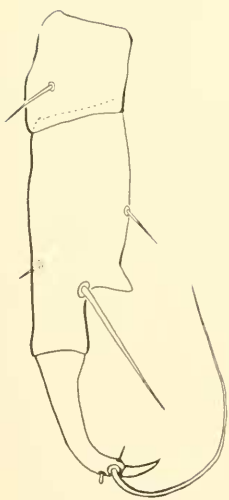
PLATE 21



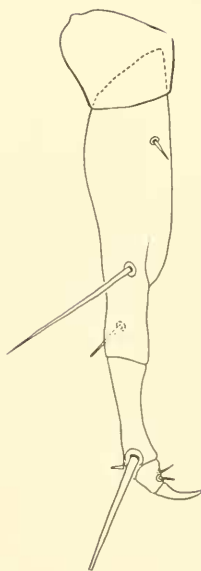
X. viridis



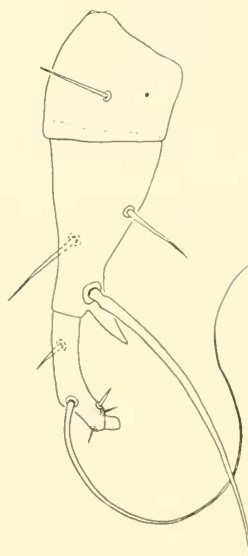
R. niger



H. tepidariorum



H. peregrinus



H. latus

PLATE 22

Tibiotarsal segments of legs I of females in the genus *Steneotarsonemus*:

S. pallidus.

S. fulgens, n. sp. (drawn from allotype).

S. ananas.

S. hyaleos, n. sp. (drawn from allotype).

S. latipes (drawn from cotype).

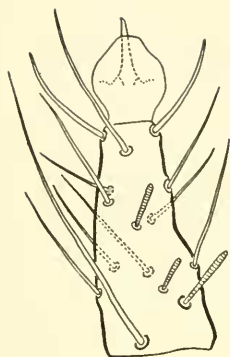
S. phyllophorus.

S. spirifex.

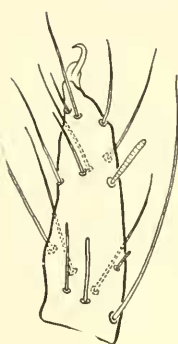
S. laticeps.

S. bancrofti.

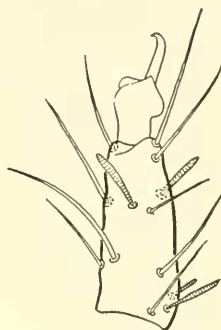
PLATE 22



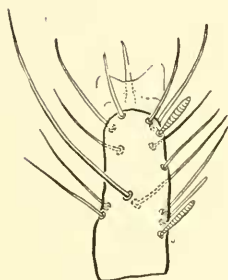
S. pallidus



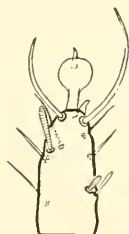
S. fulgens



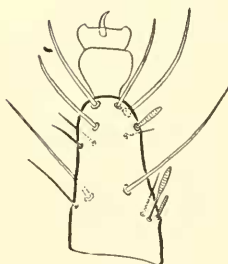
S. ananas



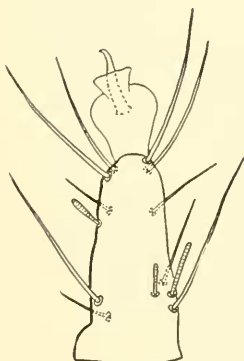
S. hyaleas



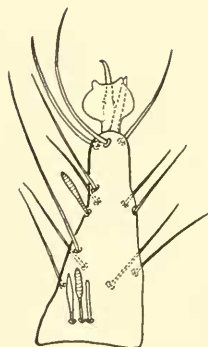
S. latipes



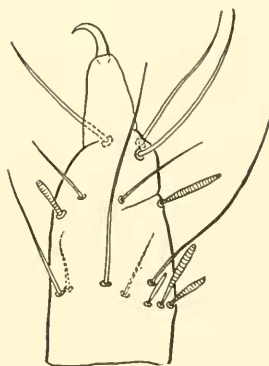
S. phyllaphorus



S. spirifer



S. laticeps



S. bancrofti

PLATE 23

Tibiotarsal segments of legs I of females:

Stencotarsonemus chionaspicorus.

Tarsonemus occidentalis.

T. setifer.

T. randsi (drawn from cotype).

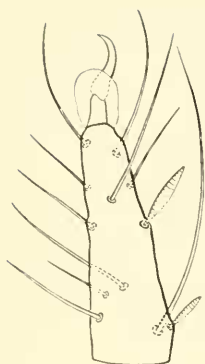
T. sulcatus, n. sp. (drawn from allotype).

T. smithi.

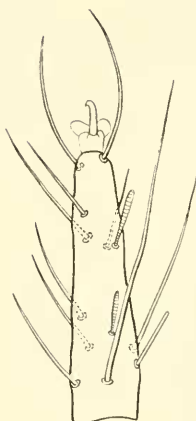
T. dispar, n. sp. (drawn from paratype).

T. cryptocephalus (drawn from cotype).

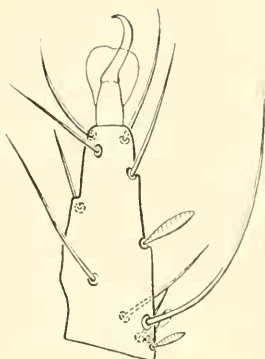
PLATE 23



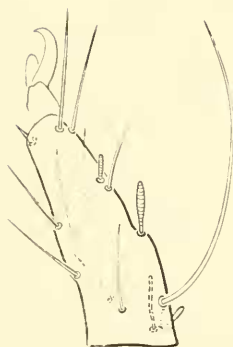
T. occidentalis



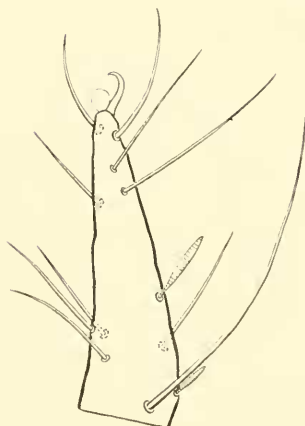
T. setifer



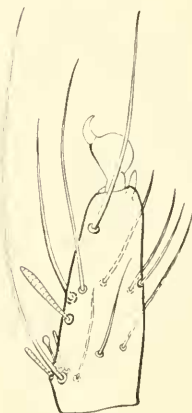
T. rondsi



T. succatus



T. smithi



T. dispar



S. chonasprius



T. cryptocephalus

PLATE 24

Tibiotarsal segments of legs I of females in the genus *Tarsonemus*:

T. confusus.

T. simplex.

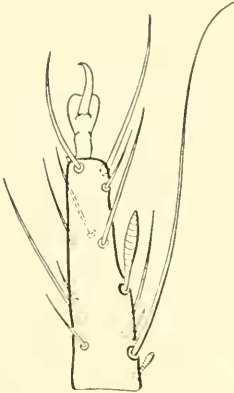
T. waitei.

T. pritchardi, n. sp. (drawn from allotype).

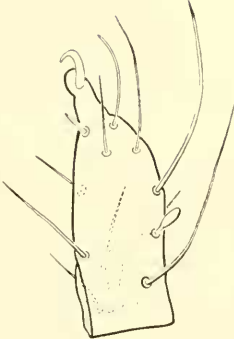
T. scaurus (drawn from cotype).

T. texanus.

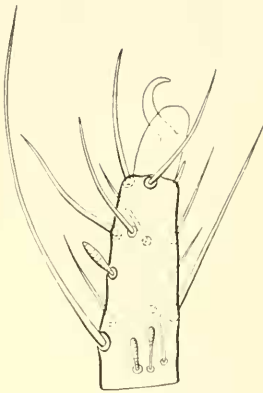
PLATE 24



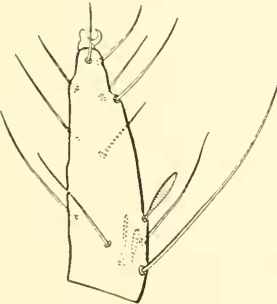
T confusus



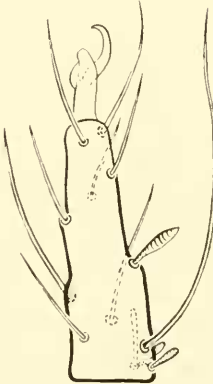
T simplex



T waiei



T pritchardi



T scourus



T texanus

PLATE 25

Tibiotarsal segments of legs I of females:

Rhynchotarsonemus niger, n. sp. (drawn from paratype).

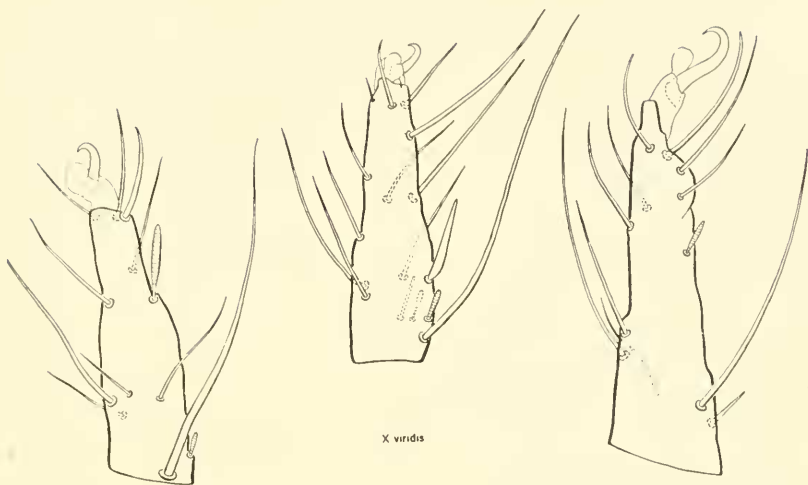
Xenotarsonemus viridis.

Hemitarsonemus peregrinus, n. sp. (drawn from paratype).

H. latus.

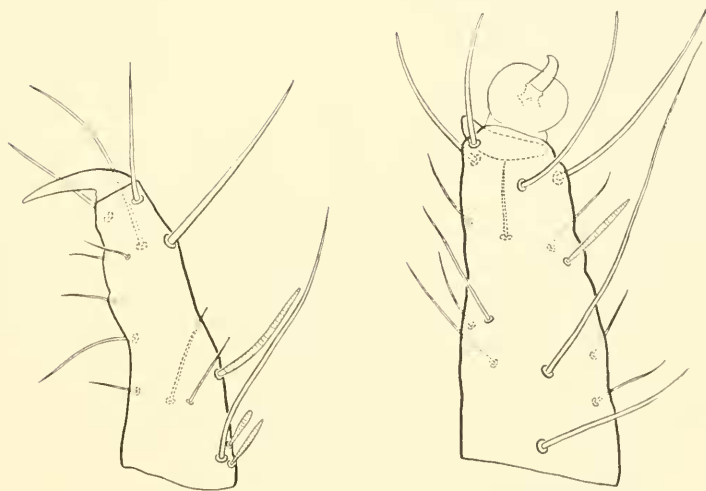
H. tepidariorum.

PLATE 25



R niger

H peregrinus



H lotus

H tepidariorum

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